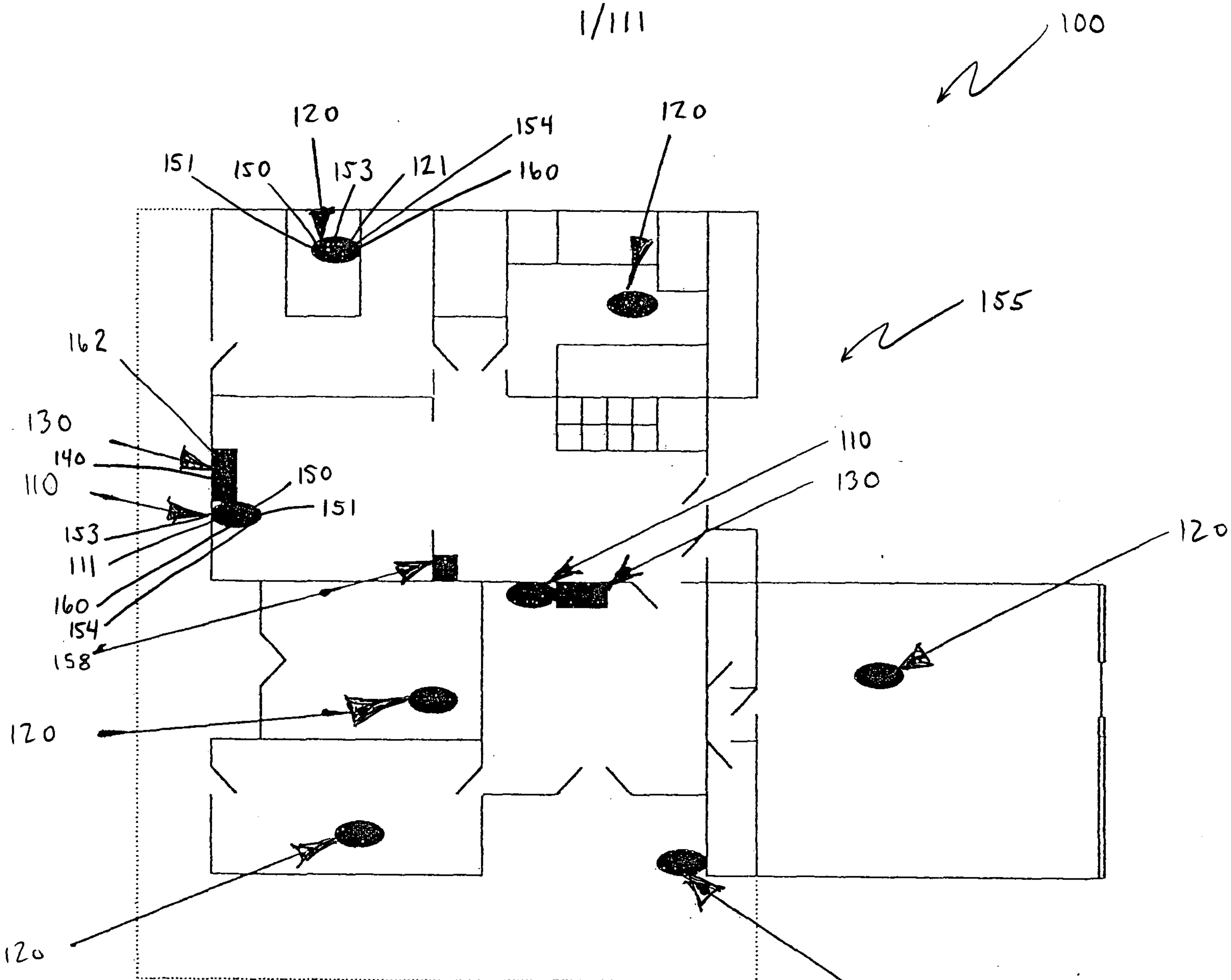

100
155
120
151
150
153
121
154
160
162
130
140
110
150
151
153
111
160
154
158
110
130
120
120
120
120
120

FIG. 1

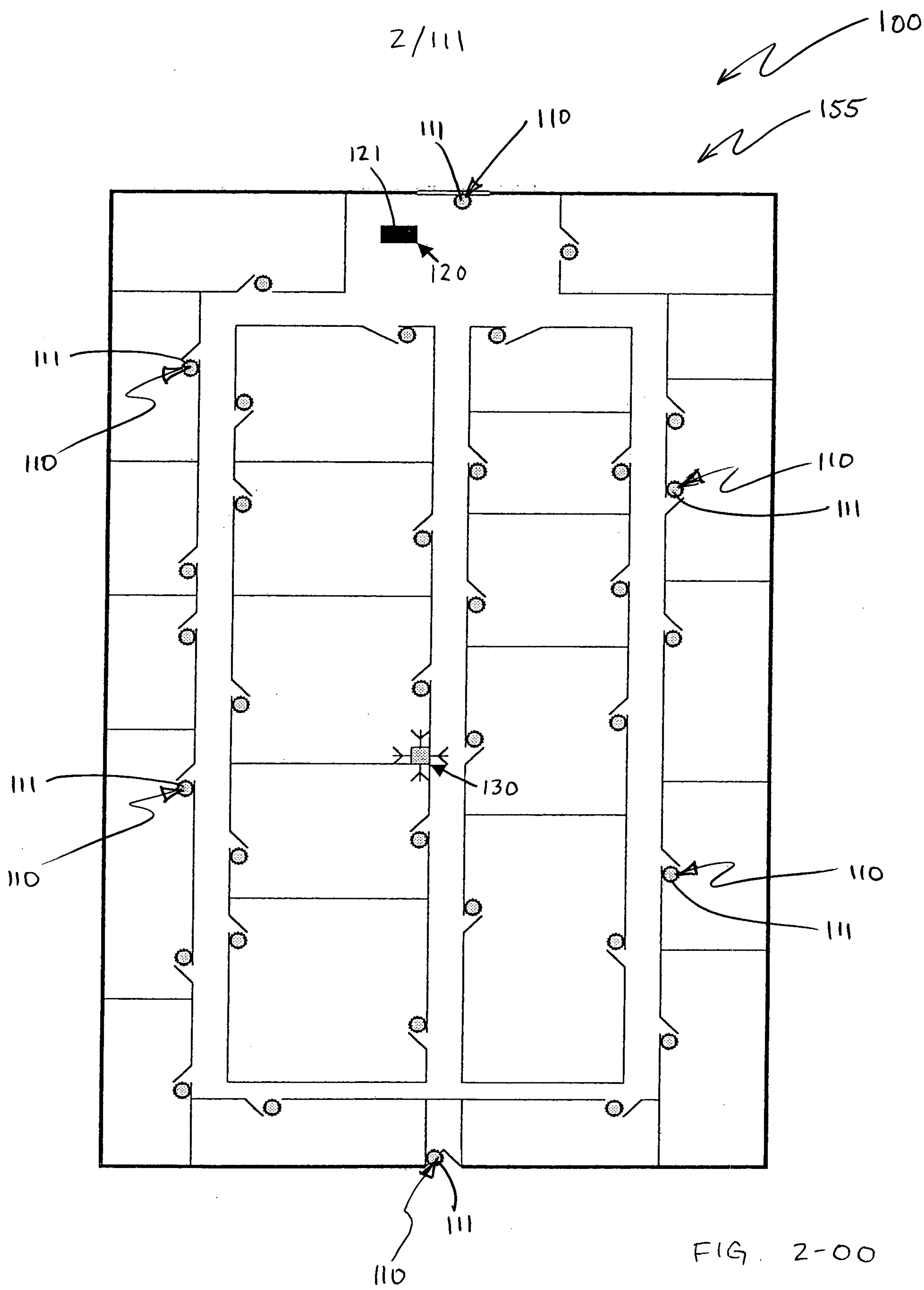

100
155
111
110
121
120
111
110
110
111
111
110
130
110
111
110
111

FIG. 2-00

rdc_trans.sch-1 - Mon Nov 18 21:54:51 2002

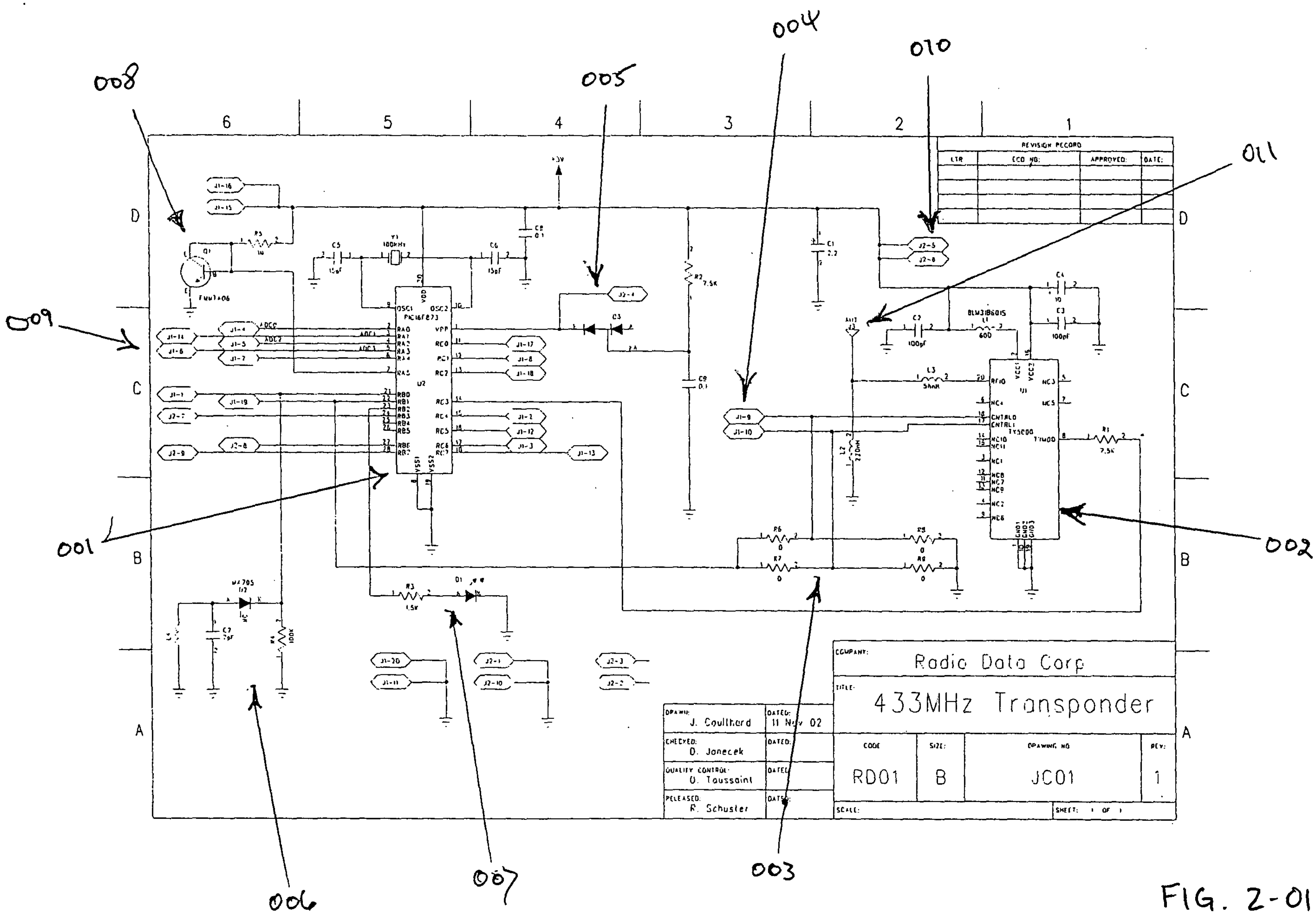


FIG. 2-01

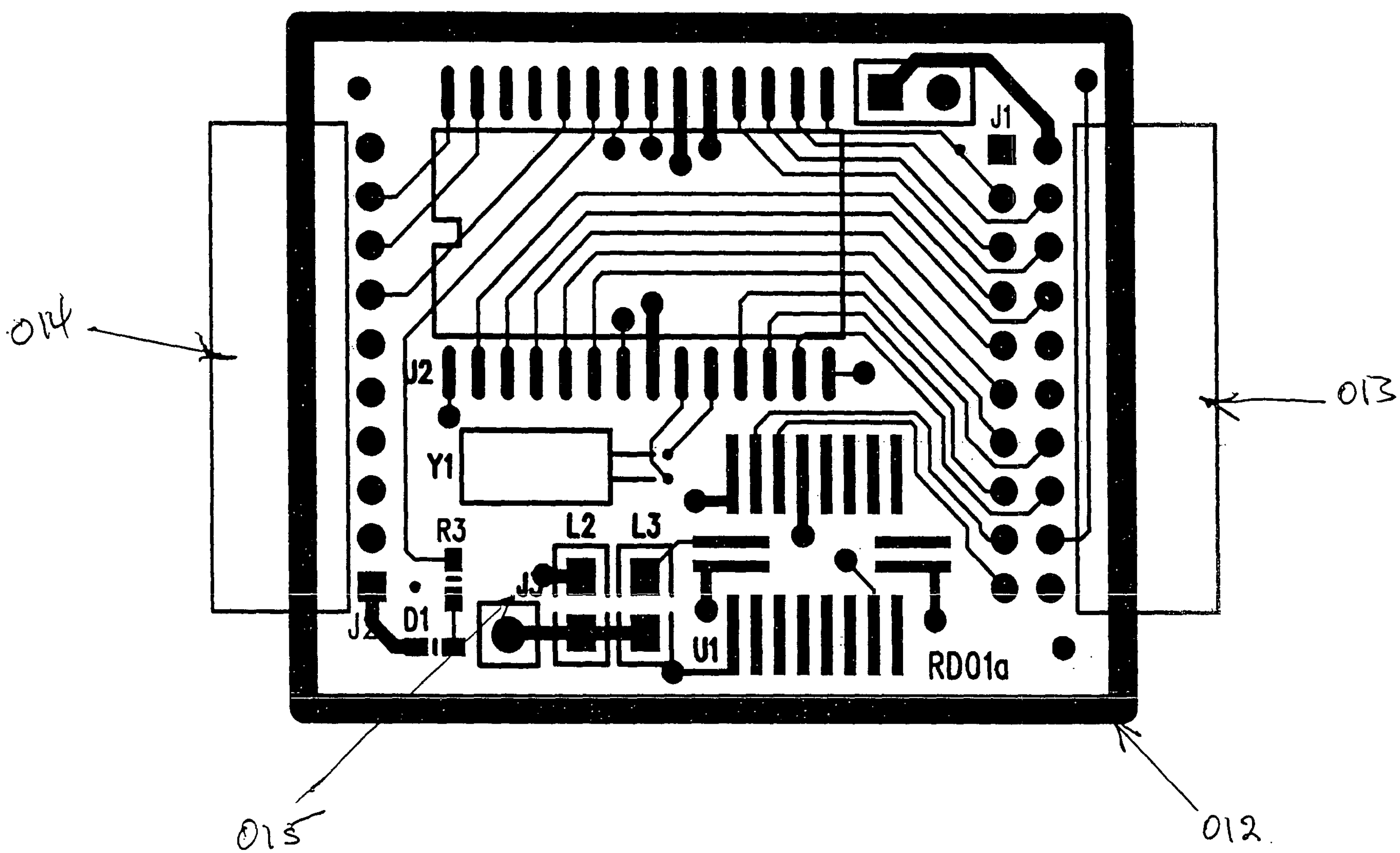


FIG. 2-02

RD01a.pcb - Mon Nov 18 21:56:42 2002

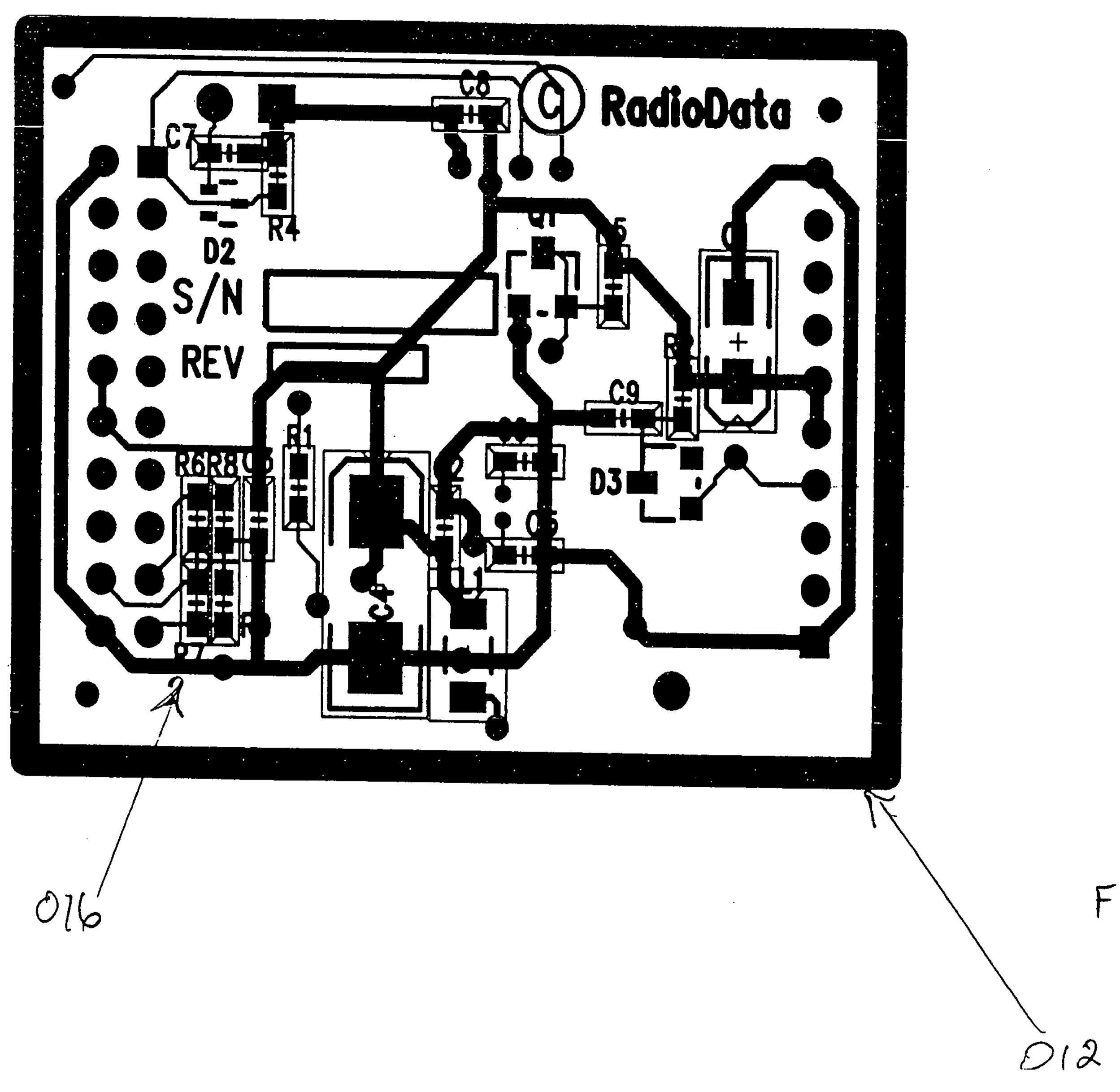
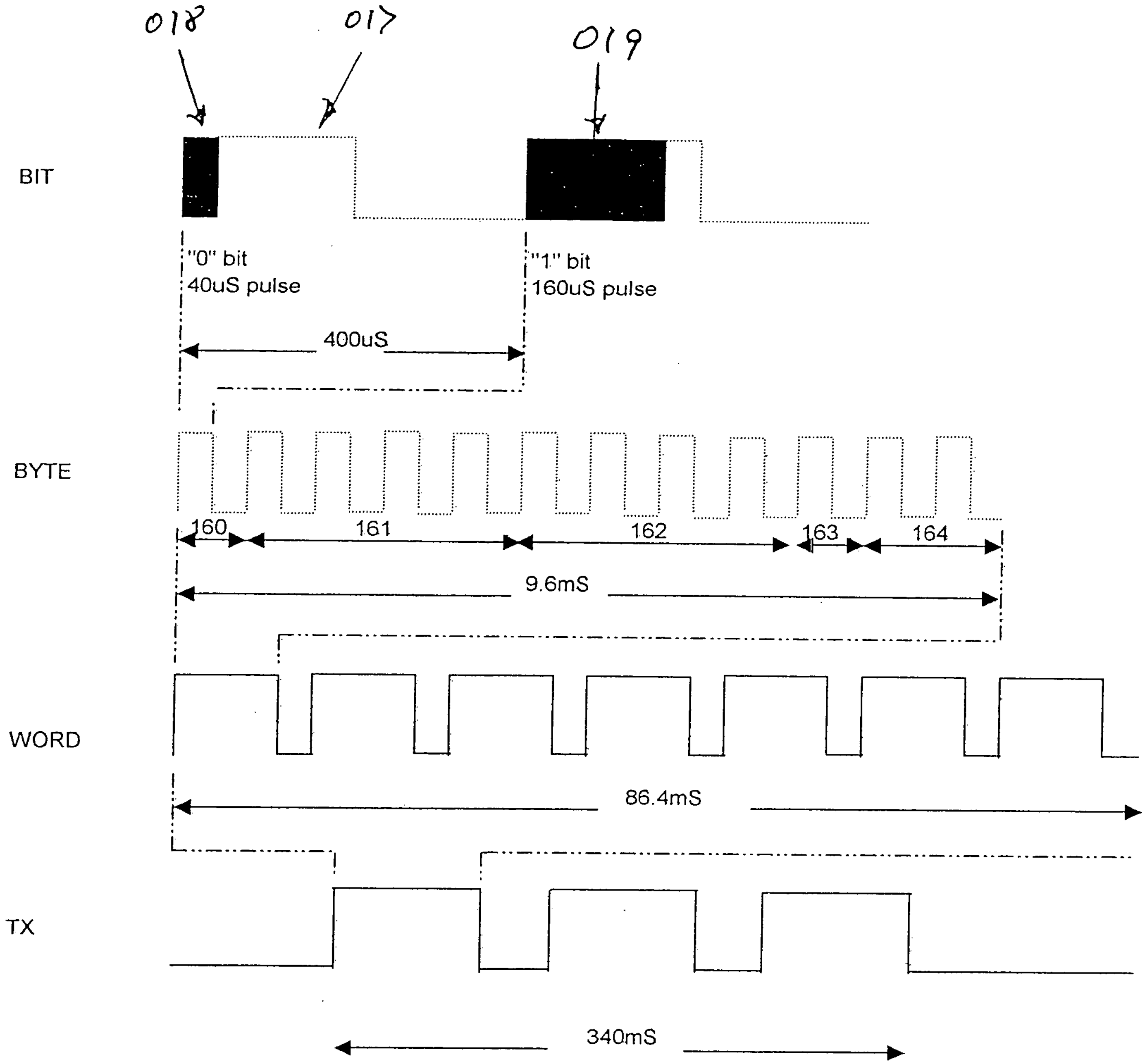

C8
C
RadioData
C7
R4
D2
S/N
REV
Q1
C5
R1
C9
D3
R6R8
C4
C2
C6
L1
A
016
012

FIG. 2-03



160	Start bit
161	Encoded characters (i.e. identity code and temperature)
162	Encoded characters (i.e. pressure and battery condition)
163	Parity bit
164	Two stop bits

Resolution Examples

Voltage resolution 0.01 V per bit (2.0 to 3.5V)
Pressure resolution 1 psi per bit (0 to 150psi)
Temperature resolution 1 C per bit (-25 to 125C)

FIG. 2-04

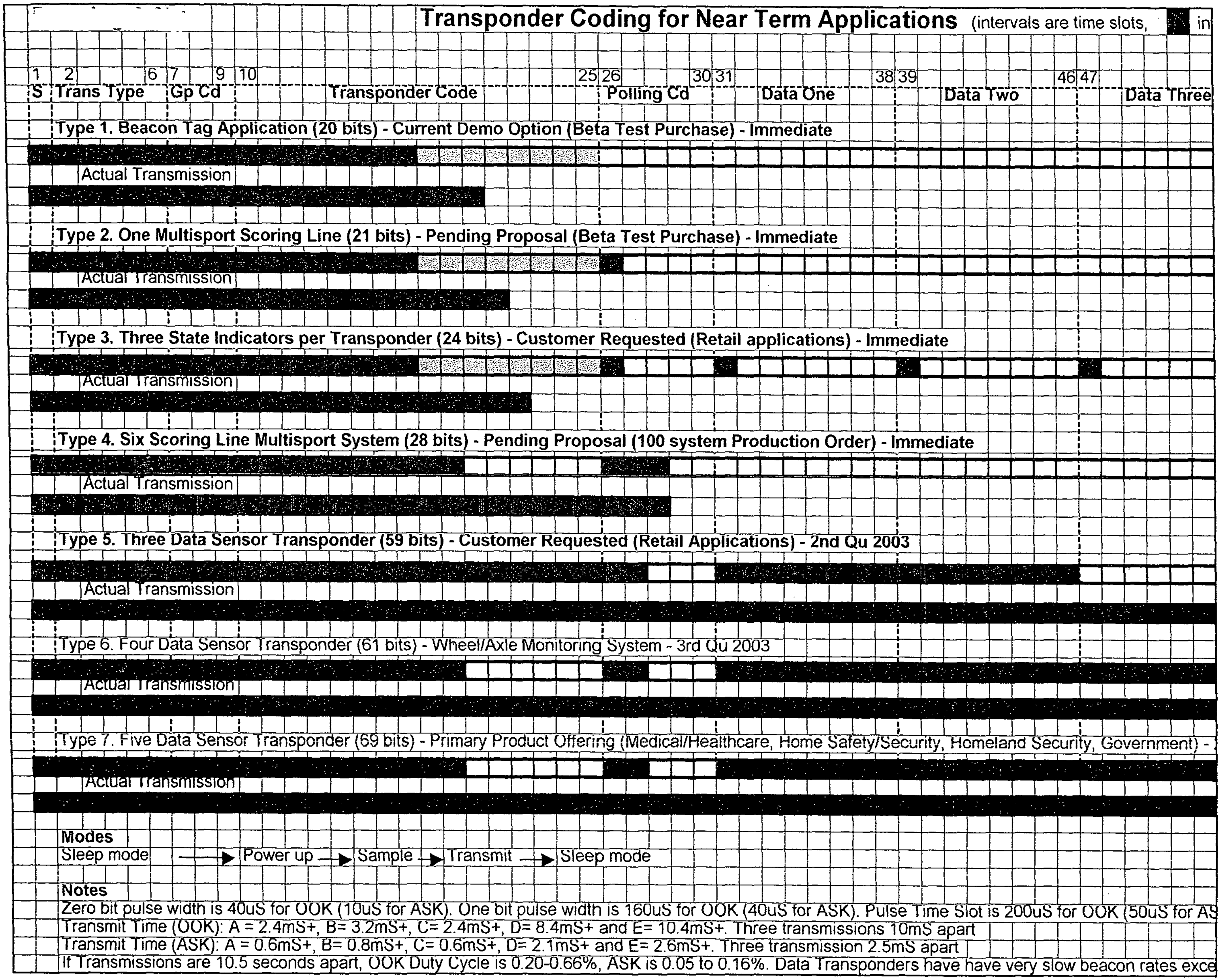

Transponder Coding for Near Term Applications (intervals are time slots, in
1 2 6 7 9 10 25 26 30 31 38 39 46 47
S Trans Type Gp Cd Transponder Code Polling Cd Data One Data Two Data Three
Type 1. Beacon Tag Application (20 bits) - Current Demo Option (Beta Test Purchase) - Immediate
Actual Transmission
Type 2. One Multisport Scoring Line (21 bits) - Pending Proposal (Beta Test Purchase) - Immediate
Actual Transmission
Type 3. Three State Indicators per Transponder (24 bits) - Customer Requested (Retail applications) - Immediate
Actual Transmission
Type 4. Six Scoring Line Multisport System (28 bits) - Pending Proposal (100 system Production Order) - Immediate
Actual Transmission
Type 5. Three Data Sensor Transponder (59 bits) - Customer Requested (Retail Applications) - 2nd Qu 2003
Actual Transmission
Type 6. Four Data Sensor Transponder (61 bits) - Wheel/Axle Monitoring System - 3rd Qu 2003
Actual Transmission
Type 7. Five Data Sensor Transponder (69 bits) - Primary Product Offering (Medical/Healthcare, Home Safety/Security, Homeland Security, Government) -
Actual Transmission
Modes
Sleep mode → Power up → Sample → Transmit → Sleep mode
Notes
Zero bit pulse width is 40uS for OOK (10uS for ASK). One bit pulse width is 160uS for OOK (40uS for ASK). Pulse Time Slot is 200uS for OOK (50uS for AS
Transmit Time (OOK): A = 2.4mS+, B= 3.2mS+, C= 2.4mS+, D= 8.4mS+ and E= 10.4mS+. Three transmissions 10mS apart
Transmit Time (ASK): A = 0.6mS+, B= 0.8mS+, C= 0.6mS+, D= 2.1mS+ and E= 2.6mS+. Three transmission 2.5mS apart
If Transmissions are 10.5 seconds apart, OOK Duty Cycle is 0.20-0.66%, ASK is 0.05 to 0.16%. Data Transponders have have very slow beacon rates exce

FIG. 2-05a

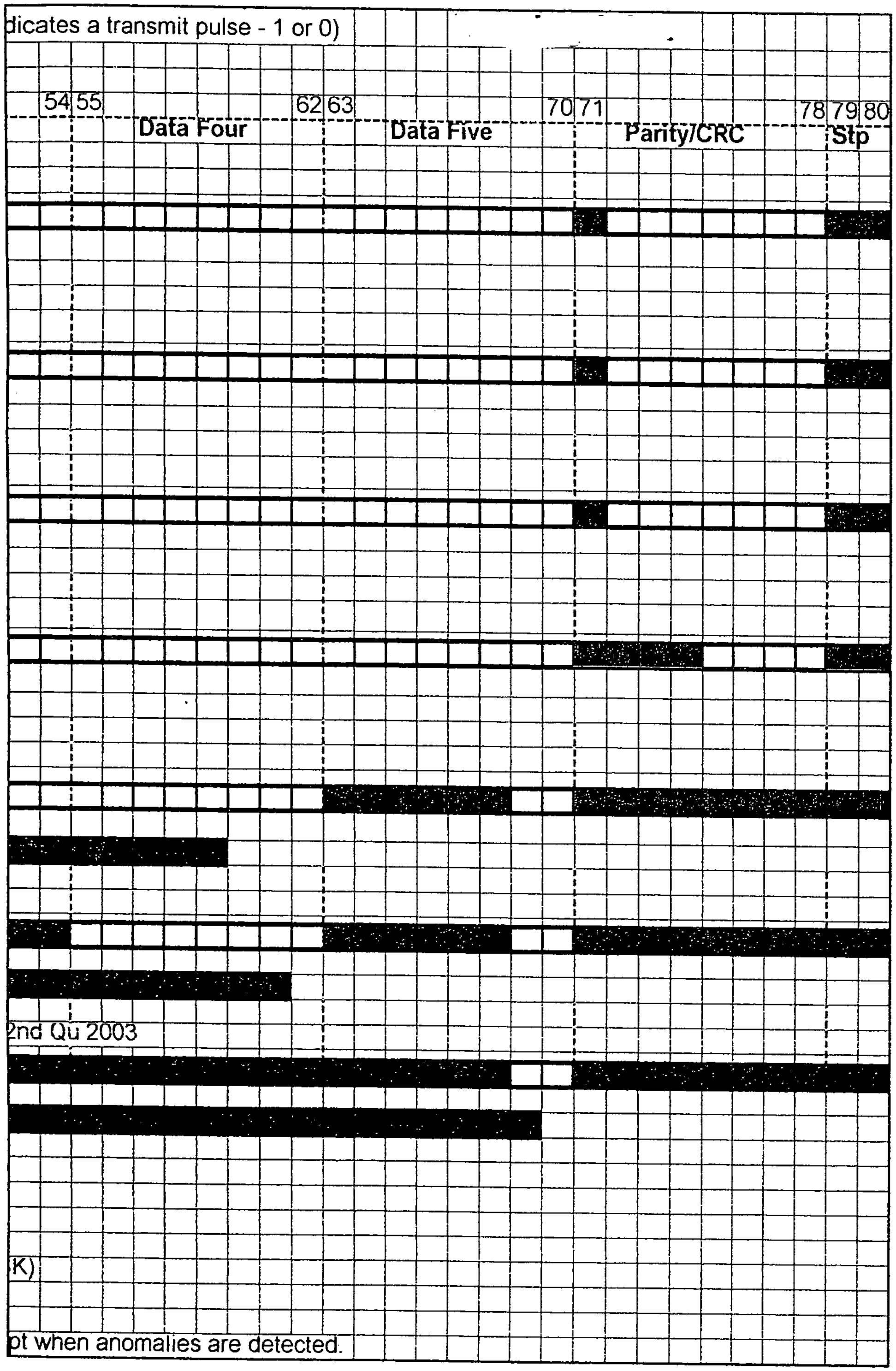

dicates a transmit pulse - 1 or 0)
54 55
Data Four
62 63
Data Five
70 71
Parity/CRC
78 79 80
Stp
2nd Qu 2003
K)
pt when anomalies are detected.

FIG. 2-05b

RadioData Application Descriptions

Transponder Firmware Proposal

1. **Generic Transponder Firmware**
   a. All Transponders require a group code. This can be one of two options building to 64 later in 2003
   b. All Transponders require a unique code. This can consist of 64 options, building to 1000 in the second quarter and 1 million in the third quarter.
   c. All transponders should beacon regularly at a beacon rate that is programmable from three times a second to once an hour.
   d. All transponders should be able to transmit immediately when a selected pin on the microprocessor goes high.
   e. All transponders should transmit their data three times with a 40mS space between each.
   f. All transponders should transmit each bit in a 200uS time slot. An "O" is represented by a 40 microsecond pulse (the first 25% of the time slot) and a "1" by three consecutive 40 microsecond pulses (the first 75% of the time slot). Start bits can be more than 3 consecutive 40 microsecond pulses and stop bits can be one or two time slots without a transmission.
   g. All transponders need by Q3'2003 to be able to transmit data representing temperature and battery condition (functions provided by the microprocessor).

2. **Specific Application Firmware**
   a. The first Transponder is a beacon tag with standard Generic Firmware, that will be used for simple demonstrations and for location only applications.
   b. The second Transponder will include the ability to append status bits to the Code. These status bits will report the high or low status of three to five microprocessor I/Os.
   c. The third Transponder needs to be able to append to the Transponder's code a simple three bit coded input to a pin on the Microprocessor (a polling signal).
   d. The fourth Transponder needs to be able to switch on power to external sensors and take analog data input to three I/O pins. It needs to take three consecutive samples, average the closest two and store that data. It needs to do this every 2 to 5 seconds, storing the average of the three last readings. Then it needs to compute the difference between the last two averages and compare the rate of change with three positive/negative rate of change limits and modify its beacon rate depending on any violation of these limits. Further it needs to compare this average of averages with three high/low pairs of limits and modify its beacon rate depending on any violation of these limits. The latest average of averages data is always transmitted at the beacon rate or the selected violation override rate. The transponder has three modes of operation; 1. sleep mode; 2. wake-up mode, power sensors, take readings, process them and compare with limits, returning to sleep mode if no anomaly is found; 3. Transmit mode.

FIG. 2-06a

e. A fifth Transponder needs to control and take digital data input and transmit it at a prescribed beacon rate or immediately when polled, appending one bit to indicate whether it is transmitting on a normal beacon schedule or because it was polled.

SCHEDULE

A.

1.a	Two Group codes
1.b	Sixty-four Unique codes
1.c	Beacon Rate – two seconds
1.d	Polling option (uncoded)
1.e	Transmit three times spaced 40mS
1.f	Standard 40uS pulse width & 200uS Time Slot - 10000 “0”, 11110 “1”
1.g	Omit
2.	Omit all

B.

1.a	Two Group codes
1.b	Sixty-four Unique codes
1.c	Beacon Rate – two seconds
1.d	Polling option (uncoded)
1.e	Transmit three times spaced 40mS
1.f	Standard 40uS pulse width & 200uS Time Slot - 10000 “0”, 11110 “1”
1.g	Omit
2.a	
2.b	

FIG 2-06b

TRANSPONDER TRANSMISSION PERIODICITY DECISION TABLE

Example of a Sensor Sampling Plan (Truck Wheel Monitoring)

Step 1	Wake up every 2 seconds, take 3 samples, average closest two readings, store in A
Step 2	Wake up every 2 seconds, move store A to store B, take 3 samples, average closest two readings, store in A
Step 3	Wake up every 2 seconds, move store B to store C, move store A to store B, take 3 samples, average closest two readings, store in A
Step 4	Compare value of data stored in A with limit table and react accordingly
Step 5	Average the averages stored in A, B and C and store in D
Step 6	Compare value of data stored in A with data stored in B, check change with Rate of Change Table and react accordingly
Step 7 plus	Continue to repeat steps 3 through 6 indefinately

Example of a Limit Table (Truck Wheel Monitoring)

Normal	Convert	Transmit	Repeat	
plus/minus	every	every	ea Tx	
0 to 12.5%	300 secs	300 secs	3 times	
12.5 to 25%	90 secs	90 secs	6 times	Warn
25 to 50%	30 secs	30 secs	25 times	Alert
over 50%	10 secs	10 secs	50 times	Alarm

Example of Rate of Change Table (Truck Wheel Monitoring)

Change	Convert	Transmit	Repeat	Action
greater than	every	every	ea Tx	
0%	450 secs	900 secs	3 times	
6.25%	150 secs	300 secs	6 times	Warn
12.50%	90 secs	90 secs	12 times	Alert 1
25%	30 secs	30 secs	25 times	Alert 2
50%	10 secs	10 secs	50 times	Alarm

Note: Each sensed parameter is analysed and the response is determined for each parameter. However the data transmission periodicity and repetition is determined by the most critical parameter (the transmission format is always the same).

FIG. 2-07

TRANSPONDER TRANSMISSION PERIODICITY TABLE II

Example of a Sensor Sampling Plan (Home/Blg. Monitoring)

Step 1	Wake up every 2 seconds, take 3 samples of all sensed parameters, average closest two readings, store in A
Step 2	Wake up every 2 seconds, move store A to store B, take 3 samples of all sensed parameters, average closest two readings, stor
Step 3	Wake up every 2 seconds, move store B to store C, move store A to store B, take 3 samples, average closest two readings, store
Step 4	Compare value of data stored in A with limit tables for each sensed parameterand react accordingly
Step 5	Average the averages stored in A, B and C and store in D for each sesned parameter
Step 6	Compare value of data stored in A with data stored in B, check change with Rate of Change Tables for each and react according
Step 7	Compare changes in several selected parameters to stored relationships to determine any relationship anamolies and react accc
Step 8 plus	Continue to repeat steps 3 through 6 indefinately

Example of a Limit Table (Home/Blg. Monitoring)

Normal	Convert	Transmit	Repeat	
plus/minus	every	every	ea Tx	
0 to 12.5%	30 mins	60 mins	3 times	
12.5 to 25%	90 secs	90 secs	6 times	Warn
25 to 50%	30 secs	30 secs	25 times	Alert
over 50%	10 secs	10 secs	50 times	Alarm

Example of Rate of Change Table (Home/Blg. Monitoring)

Change	Convert	Transmit	Repeat	Action
greater than	every	every	ea Tx	
0%	30 mins	60 mins	3 times	
6.25%	150 secs	300 secs	6 times	Warn
12.50%	90 secs	90 secs	12 times	Alert 1
25%	30 secs	30 secs	25 times	Alert 2
50%	10 secs	10 secs	50 times	Alarm

Example of Parameter Relationship Table (Home/Blg. Monitoring)

Change	Convert	Transmit	Repeat	Action
relationship	every	every	ea Tx	
A less than 5% greater or less than B or C, or B greater or less than C	30 mins	60 mins	3 times	
A greater than 5% greater or less than B or C, or B greater or less than C	150 secs	300 secs	6 times	Warn
A greater than 15% greater or less than B or C, or B greater or less than C	90 secs	90 secs	12 times	Alert 1
A greater than 15% greater or less than B or C, or B greater or less than C*	30 secs	30 secs	25 times	Alert 2
A greater than 25% greater or less than B or C, or B greater or less than C	10 secs	10 secs	50 times	Alarm

* When either of A, B or C has a limit failure of over 10% and a Rate of Change of over 5%

Note: Each sensed parameter and appropirate parameter relationship is analysed, and the response is determined for each parameter or parameter relationship. However the data transmission periodicity and repetition is determined by the most critical parameter or parameter relationship (the transmission format is always the same).

FIG. 2-08

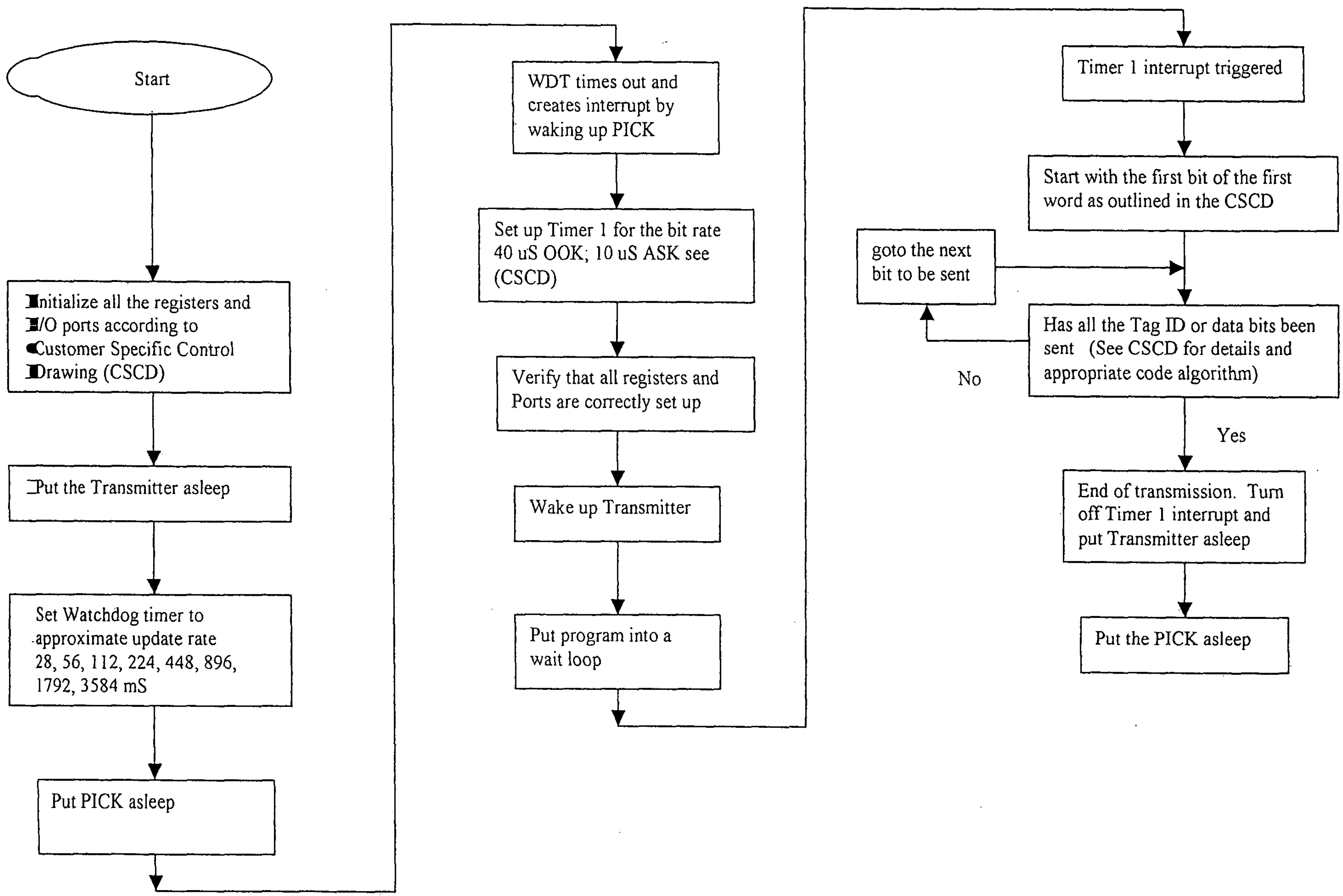

Start
Initialize all the registers and I/O ports according to Customer Specific Control Drawing (CSCD)
Put the Transmitter asleep
Set Watchdog timer to approximate update rate 28, 56, 112, 224, 448, 896, 1792, 3584 mS
Put PICK asleep
WDT times out and creates interrupt by waking up PICK
Set up Timer 1 for the bit rate 40 uS OOK; 10 uS ASK see (CSCD)
Verify that all registers and Ports are correctly set up
Wake up Transmitter
Put program into a wait loop
Timer 1 interrupt triggered
Start with the first bit of the first word as outlined in the CSCD
goto the next bit to be sent
Has all the Tag ID or data bits been sent (See CSCD for details and appropriate code algorithm)
No
Yes
End of transmission. Turn off Timer 1 interrupt and put Transmitter asleep
Put the PICK asleep

FIG. 2-09

RadioData Corporation

TRANSPONDER FREQUENCY, MODULATION, POLLING AND FIRMWARE OPTIONS

John. J. Coulthard
August 12, 2002

Part Number	Frequency	Modulation	Polling	Firmware
-000139-01-01	433.92MHz	Optional	None	Basic Demo
000139-01-02	433.92MHz	Optional	None	SSI WAMS
03-000139-01-03	433.92MHz	Optional	None	S&G Code
03-000139-01-04	433.92MHz	Optional	None	Medical I
03-000139-01-05	433.92MHz	Optional	None	Home Sec. I
03-000139-02-01	433.92MHz	OOK	None	Basic Demo
03-000139-02-02	433.92MHz	OOK	None	SSI WAMS
03-000139-02-03	433.92MHz	OOK	None	S&G Code
03-000139-02-04	433.92MHz	OOK	None	Medical I
03-000139-02-05	433.92MHz	OOK	None	Home Sec. I
03-000139-03-01	433.92MHz	ASK	None	Basic Demo
03-000139-03-02	433.92MHz	ASK	None	SSI WAMS
03-000139-03-03	433.92MHz	ASK	None	S&G Code
03-000139-03-04	433.92MHz	ASK	None	Medical I
03-000139-03-05	433.92MHz	ASK	None	Home Sec. I
03-000139-11-01	303.825MHz	Optional	None	Basic Demo
03-000139-11-02	303.825MHz	Optional	None	SSI WAMS
03-000139-11-03	303.825MHz	Optional	None	S&G Code
03-000139-11-04	303.825MHz	Optional	None	Medical I
03-000139-11-05	303.825MHz	Optional	None	Home Sec. I
03-000139-12-01	303.825MHz	OOK	None	Basic Demo
03-000139-12-02	303.825MHz	OOK	None	SSI WAMS
03-000139-12-13	303.825MHz	OOK	None	S&G Code
03-000139-12-04	303.825MHz	OOK	None	Medical I
03-000139-12-05	303.825MHz	OOK	None	Home Sec. I
03-000139-13-01	303.825MHz	ASK	None	Basic Demo
03-000139-13-02	303.825MHz	ASK	None	SSI WAMS
-000139-13-03	303.825MHz	ASK	None	S&G Code
000139-13-04	303.825MHz	ASK	None	Medical I
03-000139-13-05	303.825MHz	ASK	None	Home Sec. I
03-000139-21-01	418MHz	Optional	None	Basic Demo
03-000139-21-02	418MHz	Optional	None	SSI WAMS
03-000139-21-03	418MHz	Optional	None	S&G Code
03-000139-21-04	418MHz	Optional	None	Medical I
03-000139-21-05	418MHz	Optional	None	Home Sec. I
03-000139-22-01	418MHz	OOK	None	Basic Demo
03-000139-22-02	418MHz	OOK	None	SSI WAMS
03-000139-22-03	418MHz	OOK	None	S&G Code
03-000139-22-04	418MHz	OOK	None	Medical I
03-000139-22-05	418MHz	OOK	None	Home Sec. I
03-000139-23-01	418MHz	ASK	None	Basic Demo
03-000139-23-02	418MHz	ASK	None	SSI WAMS
03-000139-23-03	418MHz	ASK	None	S&G Code
03-000139-23-04	418MHz	ASK	None	Medical I
03-000139-23-05	418MHz	ASK	None	Home Sec. I
03-000139-31-01	916.5MHz	Optional	None	Basic Demo
03-000139-31-02	916.5MHz	Optional	None	SSI WAMS
03-000139-31-03	916.5MHz	Optional	None	S&G Code
03-000139-31-04	916.5MHz	Optional	None	Medical I
03-000139-31-05	916.5MHz	Optional	None	Home Sec. I
03-000139-32-01	916.5MHz	OOK	None	Basic Demo
03-000139-32-02	916.5MHz	OOK	None	SSI WAMS
03-000139-32-03	916.5MHz	OOK	None	S&G Code
03-000139-32-04	916.5MHz	OOK	None	Medical I
03-000139-32-05	916.5MHz	OOK	None	Home Sec. I
000139-33-01	916.5MHz	ASK	None	Basic Demo
-000139-33-02	916.5MHz	ASK	None	SSI WAMS
03-000139-33-03	916.5MHz	ASK	None	S&G Code
03-000139-33-04	916.5MHz	ASK	None	Medical I
03-000139-33-05	916.5MHz	ASK	None	Home Sec. I
03-000139-06-01	433.92MHz	Optional	13.56MHz Unc	Basic Demo
03-000139-06-02	433.92MHz	Optional	13.56MHz Unc	SSI WAMS
03-000139-06-03	433.92MHz	Optional	13.56MHz Unc	S&G Code
03-000139-06-04	433.92MHz	Optional	13.56MHz Unc	Medical I
03-000139-06-05	433.92MHz	Optional	13.56MHz Unc	Home Sec. I
03-000139-07-01	433.92MHz	OOK	13.56MHz Unc	Basic Demo
03-000139-07-02	433.92MHz	OOK	13.56MHz Unc	SSI WAMS
03-000139-07-03	433.92MHz	OOK	13.56MHz Unc	S&G Code
03-000139-07-04	433.92MHz	OOK	13.56MHz Unc	Medical I
03-000139-07-05	433.92MHz	OOK	13.56MHz Unc	Home Sec. I
03-000139-08-01	433.92MHz	ASK	13.56MHz Unc	Basic Demo
03-000139-08-02	433.92MHz	ASK	13.56MHz Unc	SSI WAMS
03-000139-08-03	433.92MHz	ASK	13.56MHz Unc	S&G Code
03-000139-08-04	433.92MHz	ASK	13.56MHz Unc	Medical I
03-000139-08-05	433.92MHz	ASK	13.56MHz Unc	Home Sec. I
03-000139-16-01	303.825MHz	Optional	13.56MHz Unc	Basic Demo
03-000139-16-02	303.825MHz	Optional	13.56MHz Unc	SSI WAMS
03-000139-16-03	303.825MHz	Optional	13.56MHz Unc	S&G Code
03-000139-16-04	303.825MHz	Optional	13.56MHz Unc	Medical I
03-000139-16-05	303.825MHz	Optional	13.56MHz Unc	Home Sec. I
03-000139-17-01	303.825MHz	OOK	13.56MHz Unc	Basic Demo
03-000139-17-02	303.825MHz	OOK	13.56MHz Unc	SSI WAMS
03-000139-17-13	303.825MHz	OOK	13.56MHz Unc	S&G Code
03-000139-17-04	303.825MHz	OOK	13.56MHz Unc	Medical I
03-000139-17-05	303.825MHz	OOK	13.56MHz Unc	Home Sec. I
03-000139-18-01	303.825MHz	ASK	13.56MHz Unc	Basic Demo
03-000139-18-02	303.825MHz	ASK	13.56MHz Unc	SSI WAMS
03-000139-18-03	303.825MHz	ASK	13.56MHz Unc	S&G Code
03-000139-18-04	303.825MHz	ASK	13.56MHz Unc	Medical I
03-000139-18-05	303.825MHz	ASK	13.56MHz Unc	Home Sec. I
03-000139-26-01	418MHz	Optional	13.56MHz Unc	Basic Demo
03-000139-26-02	418MHz	Optional	13.56MHz Unc	SSI WAMS
03-000139-26-03	418MHz	Optional	13.56MHz Unc	S&G Code
03-000139-26-04	418MHz	Optional	13.56MHz Unc	Medical I
03-000139-26-05	418MHz	Optional	13.56MHz Unc	Home Sec. I
03-000139-27-01	418MHz	OOK	13.56MHz Unc	Basic Demo
03-000139-27-02	418MHz	OOK	13.56MHz Unc	SSI WAMS
03-000139-27-03	418MHz	OOK	13.56MHz Unc	S&G Code
03-000139-27-04	418MHz	OOK	13.56MHz Unc	Medical I
03-000139-27-05	418MHz	OOK	13.56MHz Unc	Home Sec. I
03-000139-28-01	418MHz	ASK	13.56MHz Unc	Basic Demo
03-000139-28-02	418MHz	ASK	13.56MHz Unc	SSI WAMS
03-000139-28-03	418MHz	ASK	13.56MHz Unc	S&G Code
03-000139-28-04	418MHz	ASK	13.56MHz Unc	Medical I
03-000139-28-05	418MHz	ASK	13.56MHz Unc	Home Sec. I
03-000139-36-01	916.5MHz	Optional	13.56MHz Unc	Basic Demo
03-000139-36-02	916.5MHz	Optional	13.56MHz Unc	SSI WAMS
03-000139-36-03	916.5MHz	Optional	13.56MHz Unc	S&G Code
03-000139-36-04	916.5MHz	Optional	13.56MHz Unc	Medical I
03-000139-36-05	916.5MHz	Optional	13.56MHz Unc	Home Sec. I
03-000139-37-06	916.5MHz	OOK	13.56MHz Unc	Basic Demo
03-000139-37-07	916.5MHz	OOK	13.56MHz Unc	SSI WAMS
03-000139-37-08	916.5MHz	OOK	13.56MHz Unc	S&G Code
03-000139-37-09	916.5MHz	OOK	13.56MHz Unc	Medical I
03-000139-37-10	916.5MHz	OOK	13.56MHz Unc	Home Sec. I
03-000139-38-01	916.5MHz	ASK	13.56MHz Unc	Basic Demo
03-000139-38-02	916.5MHz	ASK	13.56MHz Unc	SSI WAMS
03-000139-38-03	916.5MHz	ASK	13.56MHz Unc	S&G Code
03-000139-38-04	916.5MHz	ASK	13.56MHz Unc	Medical I
03-000139-38-05	916.5MHz	ASK	13.56MHz Unc	Home Sec. I

FIG. 2-10

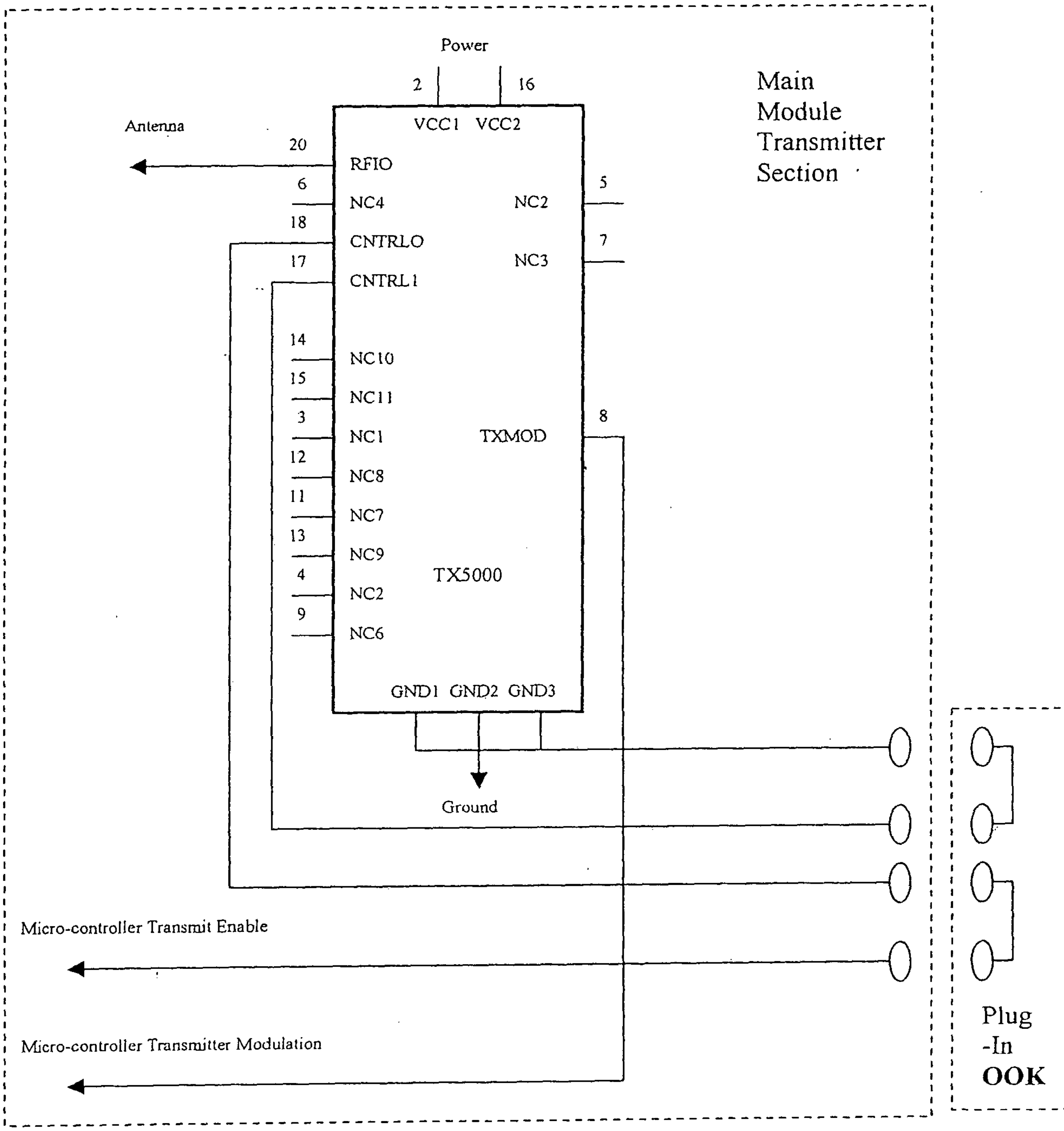

Power
2
16
VCC1
VCC2
Antenna
20
RFIO
6
NC4
NC2
5
18
CNTRLO
7
17
NC3
CNTRL1
14
NC10
15
NC11
3
NC1
TXMOD
8
12
NC8
11
NC7
13
NC9
4
TX5000
NC2
9
NC6
GND1 GND2 GND3
Ground
Main
Module
Transmitter
Section
Micro-controller Transmit Enable
Micro-controller Transmitter Modulation
Plug
-In
OOK

FIG. 2-11

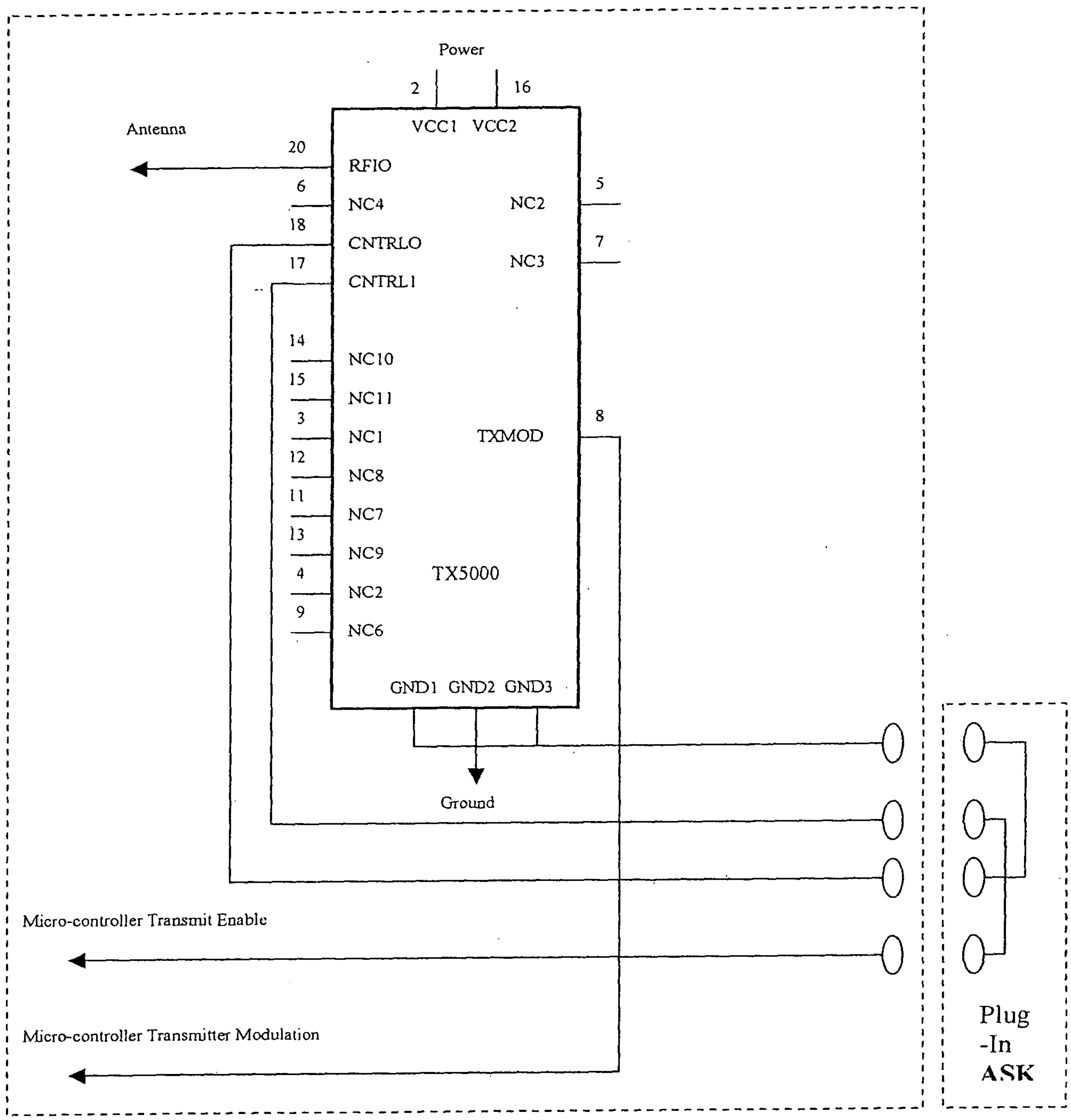

Power
2
16
VCC1 VCC2
Antenna
20
RFIO
6
NC4
NC2
5
18
CNTRLO
7
17
NC3
CNTRL1
14
NC10
15
NC11
3
NC1
TXMOD
8
12
NC8
11
NC7
13
NC9
4
TX5000
NC2
9
NC6
GND1 GND2 GND3
Ground
Micro-controller Transmit Enable
Micro-controller Transmitter Modulation
Plug
-In
ASK

FIG. 2-12

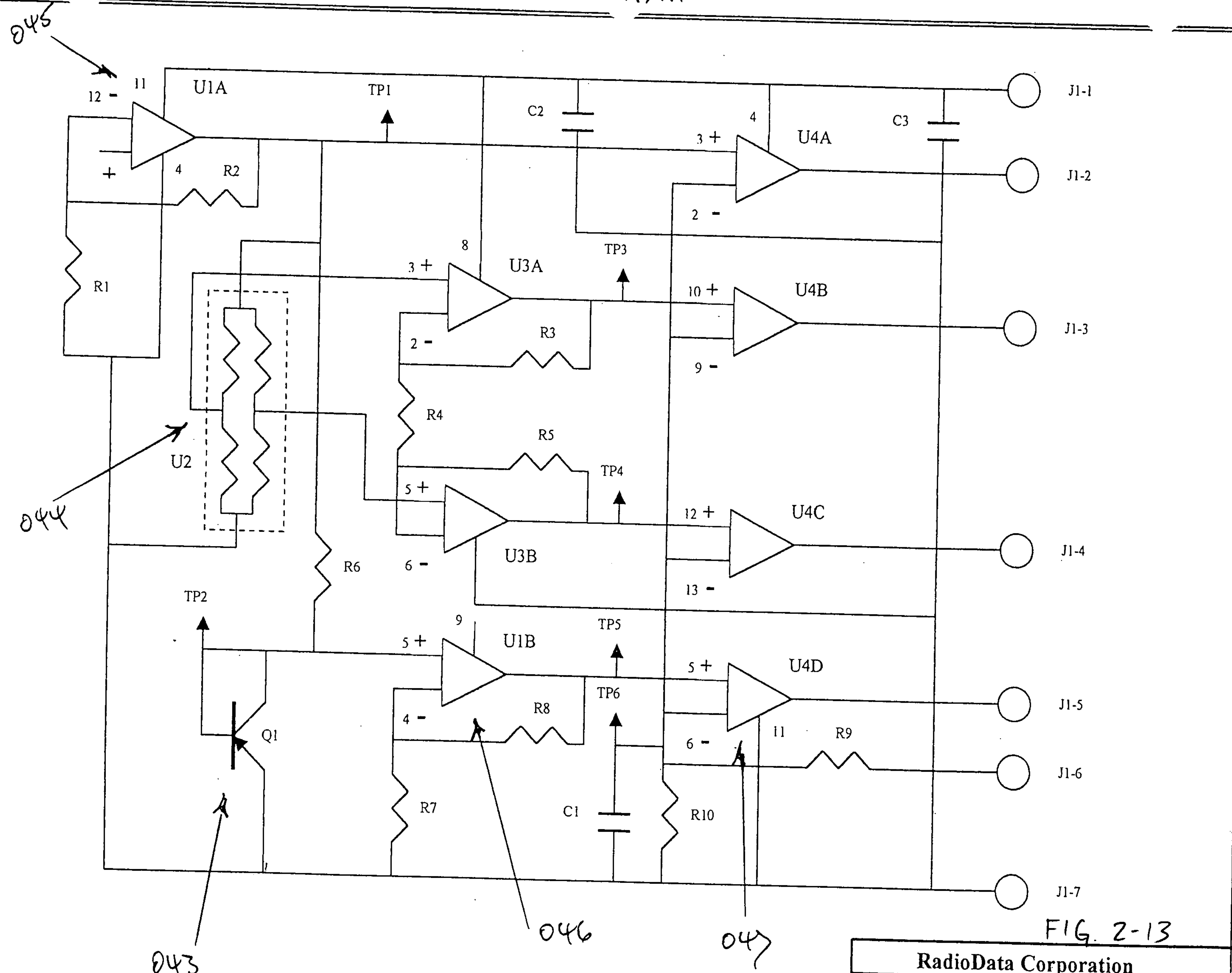


FIG. 2-13

RadioData Corporation	
Sensor Module	Dwg. No. 10011-1

Customer Sensor Modules

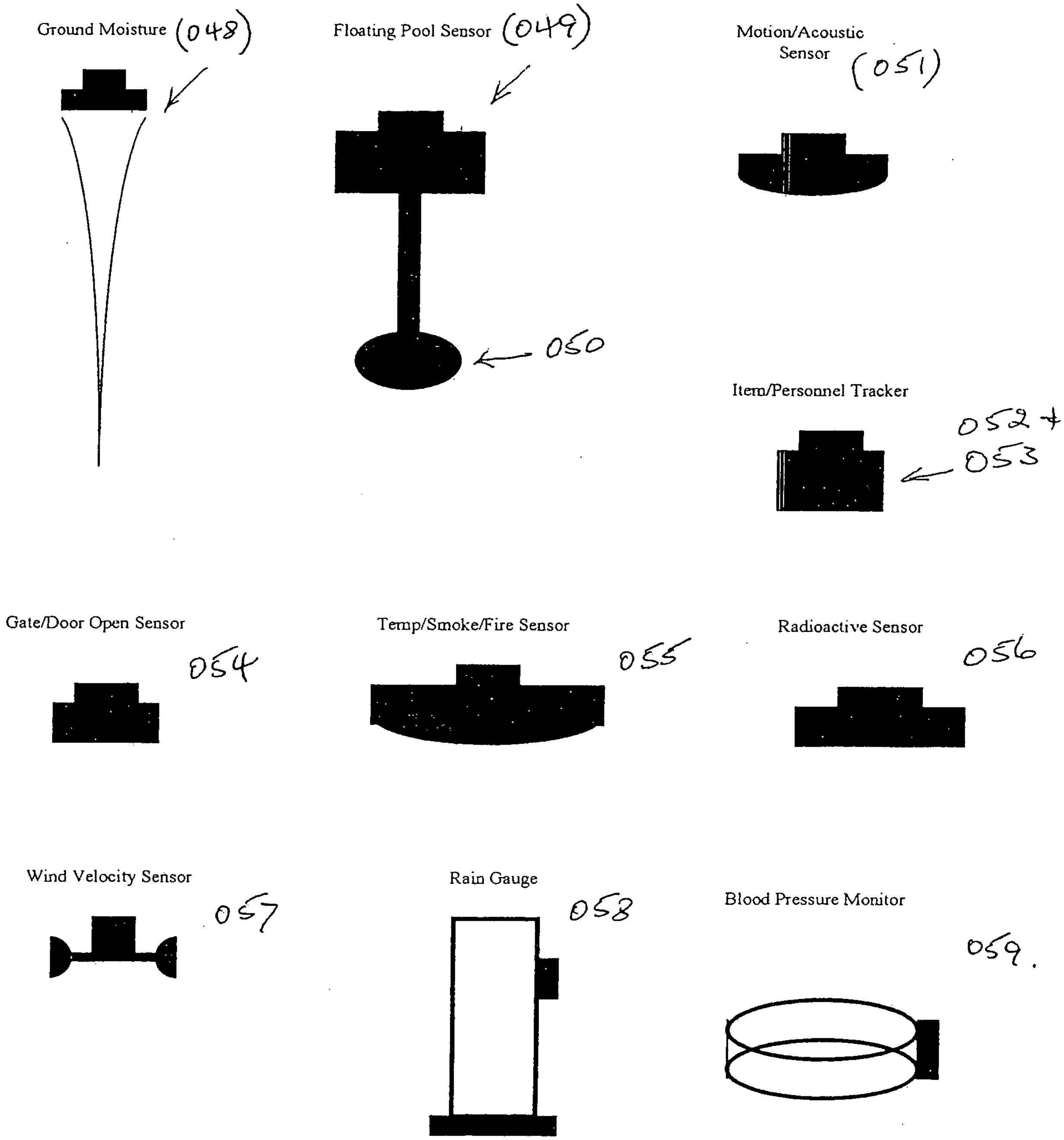


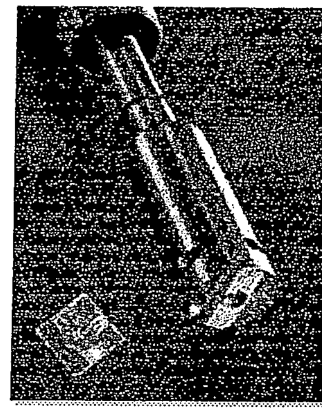
FIG. 2-14

"DASCORE Inc.....Technology for Water Quality Monitoring"

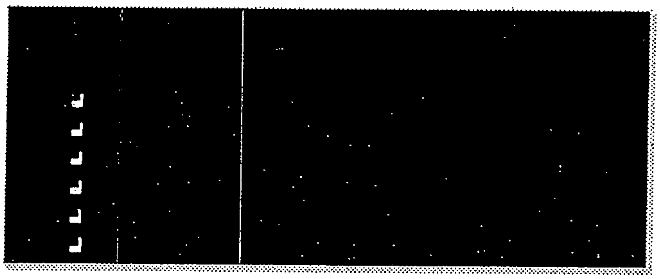
Six-CENSE™

6-in-1 Water Quality Sensor

The **Six-CENSE™** is a 6-in-1 multiparameter in-line sensor that can measure Chlorine (free chlorine), Chloramines (combined chlorine) or Dissolved Oxygen, pH, Conductivity, Oxidation-Reduction Potential, and Temperature. This electrochemical technology sits on a robust ceramic chip. **Six-CENSE™** is the only multi-parameter sensor designed for direct insertion into pressurized water mains from 2 inches to 36 inches in diameter. This capability makes the **Six-CENSE™** ideally suited to fulfill the requirements of water utilities to monitor the water quality throughout their distribution system. The unit is easy to install, simple to calibrate, and is designed for durability and minimum operator maintenance.

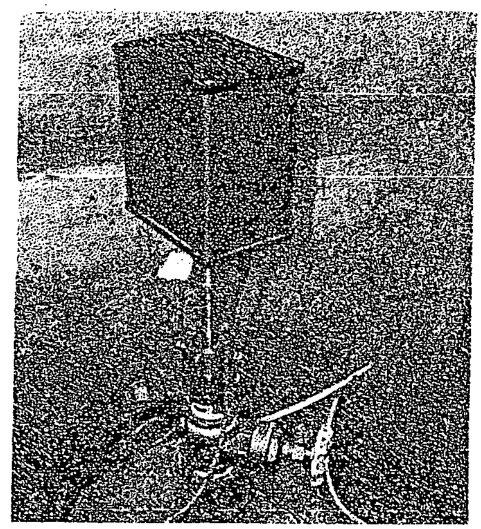


Probe Head & Chip



FEATURES:

- All data time-date stamped for analysis and liability protection.
- Data available in 4-20 mA output or LONWORKS® network variable format.
- Single point calibration.
- Direct and reagent-free measurement of Chlorine.
- Capability for measuring Combined Chlorine for plants using chloramination.
- Membrane-free measurement of Dissolved Oxygen.
- Sensor chip field replaceable with typical six-month service life.
- Units available in NEMA 4X/IP66 enclosures.
- Installs in 1.5" or 2" saddle valve, gate valve, or ball valve.



Six–CENSE™
Insertion into pipe

71 Tallwood Road
Jacksonville, FL 32250
866-321-3804 – Toll free
904-249-9283 – Facsimile
www.dascore.com
"DASCORE Inc.....Technology for Water Quality Monitoring"

FIG. 2-15a

DASCORE INCORPORATED "DASCORE Inc.....Technology for Water Quality Monitoring"

Six-CENSE™ Specifications*

Chlorine	Range	0 – 5 mg/L
	Sensitivity	<0.01 mg/L
	Accuracy	±0.04 mg/L or 5% of reading, whichever is greater
Chloramines	Range	0 – 20 mg/L
	Sensitivity	<0.05 mg/L or 5% of reading, whichever is greater
	Repeatability	+/- 0.1 mg/L or 5% of reading, whichever is greater
	Accuracy	+/- 0.1 mg/L or 5% of reading, whichever is greater

(Customer specifies either chloramines or dissolved oxygen.)

Dissolved Oxygen	Range	0 – 20 mg/L or 0 – 200% saturation
	Sensitivity	<0.1 mg/L
	Accuracy	±0.1 mg/L or 5% of reading, whichever is greater
Temperature	Range	0 – +50° C
	Sensitivity	<0.1%
	Repeatability	±0.1%
	Accuracy	±0.25° C or ±0.1% of reading, whichever is greater
Conductivity	Range	0.1 – 10.0 mS/cm
	Sensitivity	<10μS/cm
	Repeatability	±10μS/cm or ±1% of reading, whichever is greater
pH	Range	2 – 12
	Sensitivity	<0.1 pH
	Repeatability	±0.1 pH
	Accuracy	±0.5 pH
Redox/ORP	Range	-1.4 to 1.4 V
	Sensitivity	<1% of range
	Repeatability	±1% of range
	Accuracy	±1% of range

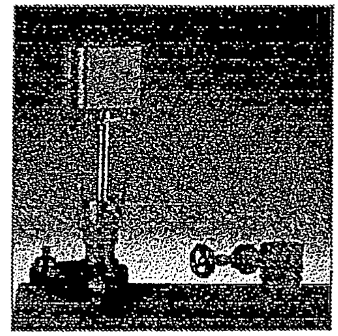
Reference Electrode
Silver/Silver Chloride type
Drift <5mV in six months
Operational life: Typical six-month continuous operation

Probe Head
Diameter 37 mm (1.48")
Quick release bayonet fitting of sensor chip
Pressure tested to 350 psi, 230 psi continuous rating
Direct insertion into pipe, through gate valve or metering box

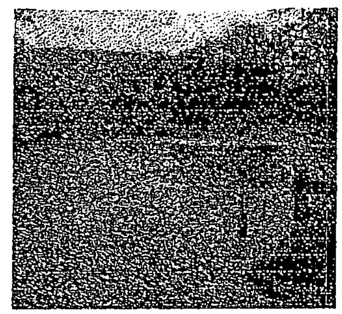
Electronics
Available with 4-20 mA or LONWORKS® output. Please contact your Dascore Inc. sales representative.

*Specifications subject to change without notice.

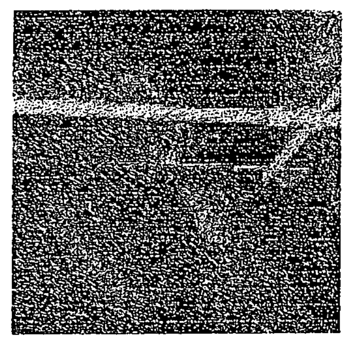
Monitoring Applications:



Finished Water



Source Water



Wastewater- Final Effluent

Our goal is to provide the most cost-effective water quality monitoring technology worldwide.

DASCORE INCORPORATED

71 Tallwood Road
Jacksonville, FL 32250
866-321-3804 – Toll free
904-249-9283 – Facsimile
www.dascore.com

"DASCORE Inc.....Technology for Water Quality Monitoring"

FIG. 2-15b

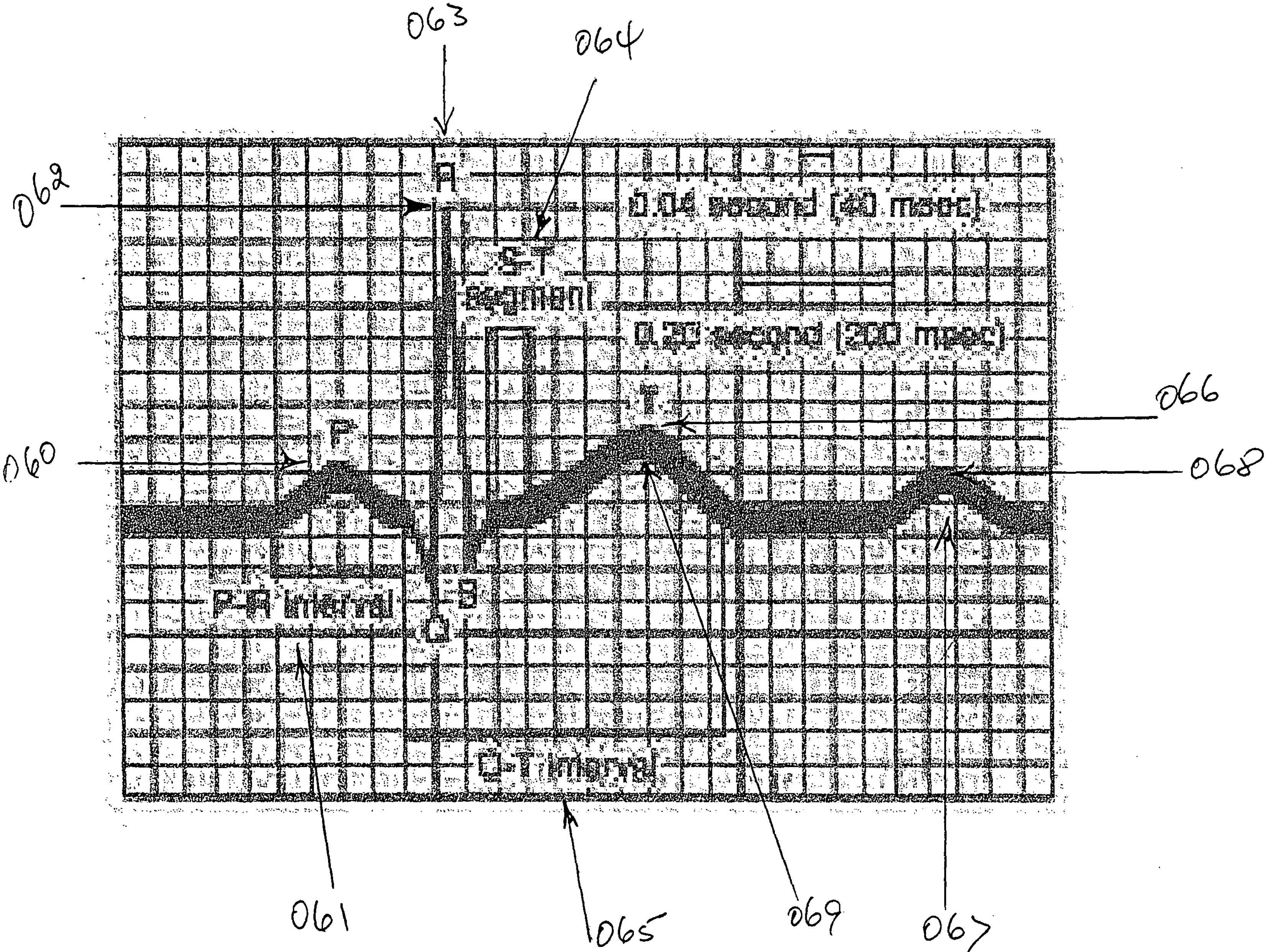

063
064
062
R
0.04 second (40 msec)
S-T
segment
0.20 second (200 msec)
066
T
P
060
068
Q
S
P-R interval
Q-T interval
061
065
069
067

FIG. 2-16

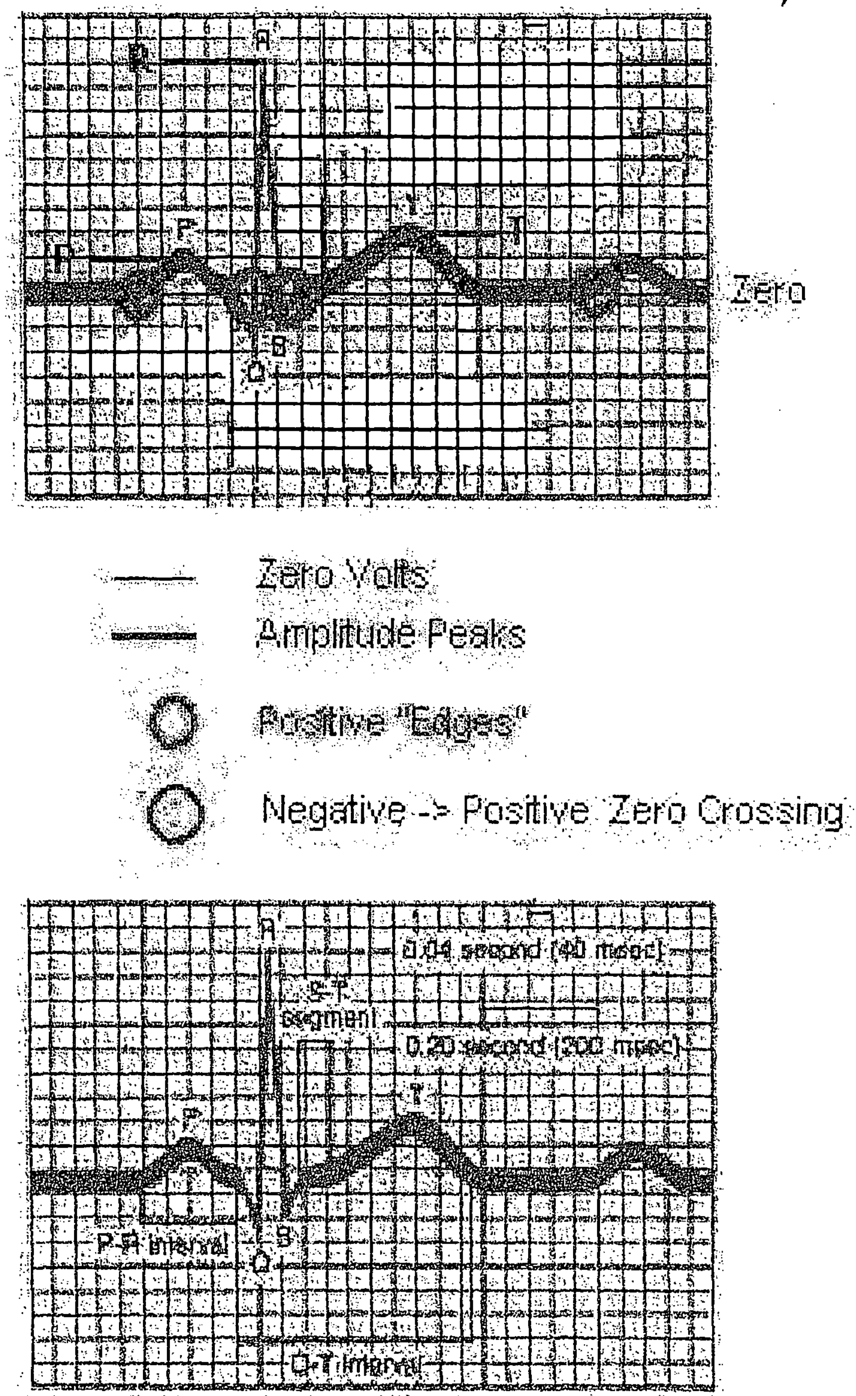

R
P
Q
S
T
Zero
Zero Volts
Amplitude Peaks
Positive "Edges"
Negative -> Positive Zero Crossing
0.04 second (40 msec)
S-T segment
0.20 second (200 msec)
P-R interval
Q-T interval

FIG. 2-17

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SPG

Specifications for the LFAFE, the low frequency analog front end. SPG0402

General Description: The LFAFE is a mixed signal CMOS monolithic device that acts as an analog front end or interface to a set of sensors. The device provides a programmable current to energize these sensors and measures the response from the sensors. A clock oscillator is provided on chip for timing purposes. A voltage reference is implemented on chip for use in A/D conversion of the sensed outputs. A communication interface using a three wire channel is used to communicate with the device. Communications consist of programming a channel identification, sensor drive current and settling time delay for the A/D conversion. Control logic for the various operations resides on chip. External components consist of sensors and miscellaneous resistors and capacitors for timing. The device is packaged in a 16 pin plastic package or can be delivered as a die for direct chip on board mounting.

Functional Block Diagram:

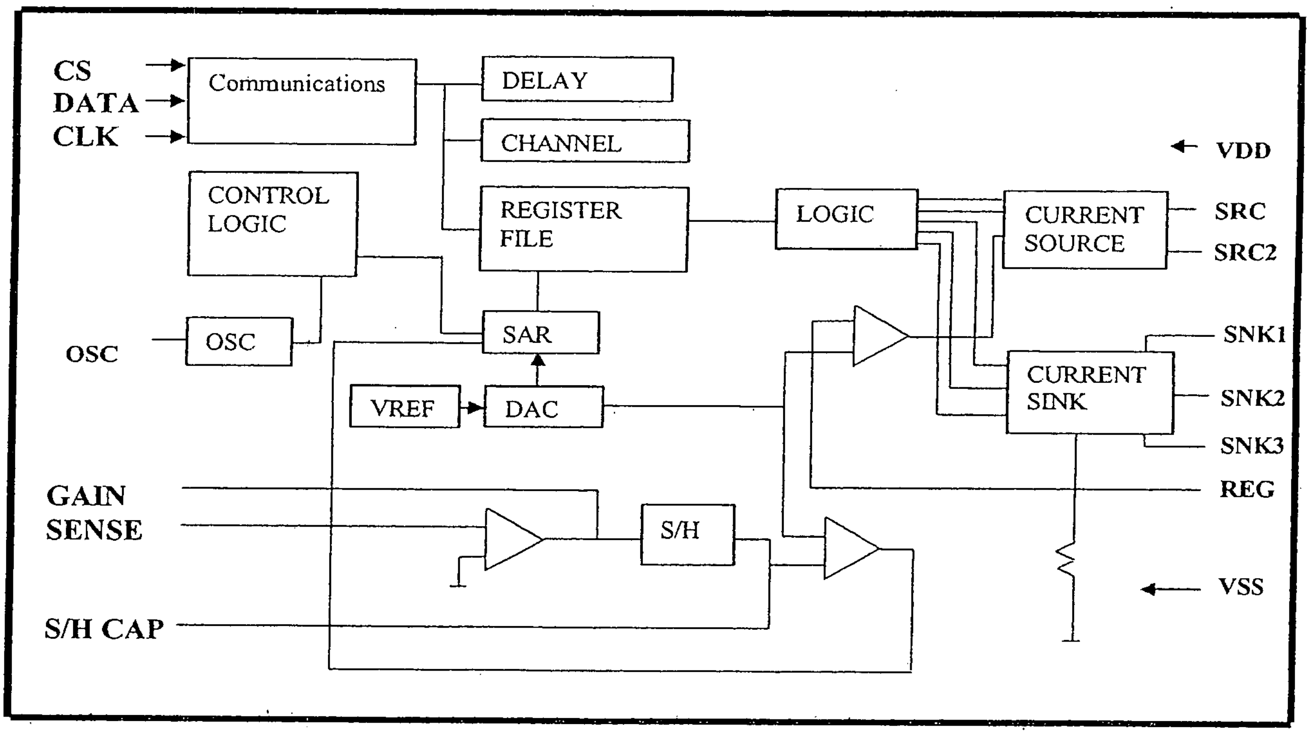

FIG. 2-18a

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LFAFE PACKAGE PINS

Pin	Name	Description
1	SDA	Bi-directional pin. Serial data.
2	SCL	Input Pin. Serial Clock
3	ECS	Output pin. EEPROM Select.
4	SRC1	Output pin. SENSOR Drive (Current Drive).
5	SRC2	Output pin. SENSOR Drive (Current Drive)
6	REG	Output pin. Establish level of current drive for SRC1, SRC2.
7	SNK3	Output pin. Current sink 3.
8	VSS	Ground or common.
9	SNK2	Output pin. Current sink 2.
10	SNK1	Output pin. Current sink 1.
11	GAIN	Output pin. Gain set for internal amplifier for sensing the response current.
12	SHCAP	Input pin. External capacitor for sample and hold function
13	SENSE	Input pin. Sense the output currents from photo-diodes or other sensing element.
14	REF	Output pin. Reference voltage for the DAC.
15	OSCCAP	Input pin. External capacitor for oscillator in analog section.
16	VDD	5.0 Volt. Positive supply voltage.

LFAFE OPERATION

The LFAFE typically needs an EEPROM and a host micro-controller for its operation. The host controls the LFAFE operation and communicates with the EEPROM via read/write commands transmitted over the serial interface. Only two signals are required to operate the serial interface, SDA and SCL. In a custom system on a chip, application the customer may choose to implement all these macro blocks on the same chip, thereby evolving a new machine. *Since the LFAFE is a fully tested functional block as well as the EEPROMs and uC this is a perfectly viable choice and a low risk implementation.*

Data is clocked in to the LFAFE on the positive edge of SCL. Normally SDA only changes when SCL is low. There are two exceptions: the START and STOP conditions.

START Condition: Positive transition on SDA when SCL is high.
STOP Condition: Negative transition on SDA when SCL is high.

The first data bit following the start condition determines whether the LFAFE is to be selected or the EEPROM. The complement of this bit is output on ECS which is connected to the CS pin on the EEPROM. When the EEPROM is selected the LFAFE ignores any further start conditions or data and disables itself until a stop condition is selected. A stop condition also causes the EEPROM chip select signal to be pulsed low.

FIG. 2-18b

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The stop condition can occur at any time and terminates any operation that may be in progress.

The LFAFE is selected with the first data bit being a 1. The next bit specifies a read (0) or a write(1) operation followed by a 4 bit address. If a write operation is specified the following bits are read in to the selected register, *high bit first*. If a read operation is selected the LFAFE pulls SDA low when the data is ready to be transmitted and the data bits are then clocked out following the negative SCL transition.

There are 14 logical registers, 8 real read/write registers (LD1 – LD6, DLY and OC) and 6 "sensor reading" read-only registers (CH1 – CH6). The 8 real registers are the 6 SENSOR (or current drive) registers, a delay register and an oscillator compensation register. These registers are initialized by the host with the corresponding calibration values stored in the neighboring EEPROM. The 6 sensor reading registers are not actual registers. A read operation of one of these pseudo registers causes the LFAFE to take a reading of the sensor specified by the address and return this value as the data portion of the read operation. The take-readings operation is triggered by the negative transition of SCL of the last address bit. The LFAFE pulls the SDA line low when the reading has been taken and the data is ready to be clocked out.

The following table lists the available commands. The SDA bits driven by the LFAFE are underlined.

	Select	R/W	Address	Ready	Data
Read SENSOR Drive Registers 1-6					
	0	0	0000	<u>0</u>	<u>LLLLLLLL</u>
	0	0	0001	<u>0</u>	<u>LLLLLLLL</u>
	0	0	0010	<u>0</u>	<u>LLLLLLLL</u>
	0	0	0011	<u>0</u>	<u>LLLLLLLL</u>
	0	0	0100	<u>0</u>	<u>LLLLLLLL</u>
	0	0	0101	<u>0</u>	<u>LLLLLLLL</u>
Read Delay Register					
	0	0	0110	<u>0</u>	<u>DDDDD</u>
Read Oscillator					

FIG. 2-18c

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Register					
	0	0	0111	0	SSSSS

Register Table continued.

Obtain Current Readings from Channel 1-6					
	0	0	1000	0	RRRRRRRR
	0	0	1001	0	RRRRRRRR
	0	0	1010	0	RRRRRRRR
	0	0	1011	0	RRRRRRRR
	0	0	1100	0	RRRRRRRR
	0	0	1101	0	RRRRRRRR
Undef.					
	0	0	1110		
	0	0	1111		
Write output current drive registers					
	0	1	0000		LLLLLLLL
	0	1	0001		LLLLLLLL
	0	1	0010		LLLLLLLL
	0	1	0011		LLLLLLLL
	0	1	0100		LLLLLLLL
	0	1	0101		LLLLLLLL
Write Delay Register					
	0	1	0110		DDDDD
Write Osc.					

FIG. 2-18d

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Register					
	0	1	0111		SSSSS

After a read operation SDA is released to a high state following the last valid output bit. A write to a register occurs after the rising edge of the last data bit clocked in. Additional data bits clocked in after a write operation are either ignored or treated as a new command or used to write the next real register.

Normal Operation
The host micro-controller initializes the LFAFE by reading the calibration values from the EEPROM. This is achieved by generating a start condition, clocking in a 0 data bit at which point the LFAFE will pull the EEPROM's chip select pin high. The host can now communicate with the EEPROM since its CS pin is high and the LFAFE is ignoring SDA and SCL apart from waiting for a stop condition. Once the EEPROM has been read, the host issues a stop condition, at which point the LFAFE pulls the EEPROM's CS pin low. The host then issues another start condition followed by a 1, followed in turn by the address of the LD1 register, 0000. This is followed by the 8 data bits to be written to LD1. Then a stop condition is issued. LD2 through OC are written in the same fashion to complete the initialization sequence.

During normal operation, the host will obtain a set of readings from the LFAFE by issuing a set of read commands in order. Detailing this sequence, the host first issues a start condition followed by a 1 to select the LFAFE. Then a 0 will be issued indicating a read followed by the first sensors pseudo register's address, 1000. The host leaves the SCL signal low and lets SDA go high and waits for the LFAFE to pull SDA low to indicate the take-reading operation is completed and the reading is available. The host then drives SCL to clock the data bits out of the LFAFE and finishes with a stop condition. This process is repeated for sensors 2 through 6.

The host can issue a stop condition to terminate the take – reading operation prematurely. This may be useful for situations where the current drive may be causing a brown-out in low power situations.

LFAFE operation timing diagram

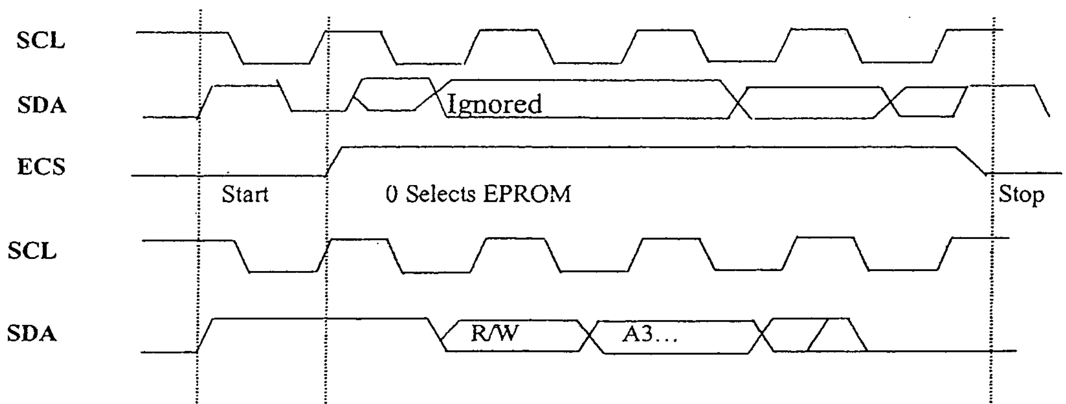

FIG 2-18e

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ECS

Start 1 Selects LFAFE Stop

Summary of Operation

The LFAFE generates two current drives. These drives are used to power drive elements. The drive element state is sensed by a set of sensors. The sensor output, current is sensed by an amplifier which pre-conditions the outputs for A/D conversion. The LFAFE does a A/D conversion and stores the output into a register for transmission to the outside world on command. The current drives are determined by a DAC and the reference current is determined by a voltage reference and a reference resistor. Registers are provided for storage and control of the operation. An oscillator sets the timing of the operation. A few external components are needed such as the oscillator capacitance, the current setting resistor, the sample and hold capacitance and the gain setting resistor. Other components for system level operation are the EEPROM which stores calibration coefficients and the host micro-controller which is a 8 bit uC.

Electrical Specifications:

ABSOLUTE MAXIMUM RATINGS

Parameter	**Symbol**	**Rating**	**Units**
Voltage at any pin	VMAX	7.0	Volt
Current at any pin	IMAX	100	mA
Operating Temperature	TMAX	100	Deg C
Storage Temperature	TST	160	Deg C
Soldering Temperature for 10 sec	TSOL	300	Deg C

Note: Sustained operation at or above these ratings may cause permanent damage to the device.

STATIC ELECTRICAL PARAMETERS

Parameter	**Conditions**	**Min**	**Typ**	**Max**	**Units**
VDD Supply	Operating	4.5	5.0	5.5	Volt
IDD Supply current	Except for current drive			2.5	mA
Temperature	Operating	0		70	Deg C

FIG. 2-18f

Voltage Reference	Max at REG output, depends on DAC output.			3.6	Volt

DIGITAL SPECIFICATIONS

Parameter	Conditions	Min	Typ	Max	Units
CMOS High Level Output VOH	Iout=10uA	VCC-0.5			Volt
CMOS Low level Output VOL	Iout=100uA			0.5	Volt
CMOS High Level Input VIH		VCC-0.5			Volt
CMOS Low Level Input VIL				0.5	Volt
Clock rate				1	MHz
Data Length				20	Bits
CS Hold time				500	ns
CS Setup time				500	ns
Register File Rows				8	
Register File Columns				8	
Register read/write setup time				500	Ns
Register read/write hold time				500	Ns
Delay Time		50		3200	ms

OSCILLATOR CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
OSC frequency range		100		500	KHz
OSC frequency tolerance	Trimmed OSC			2.5	%
OSC Capacitance.			560		pF

Note: The oscillator requires an external capacitance which determines the frequency. The oscillator provides timing for the A/D Conversion and the delay.

FIG. 2-18g

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TRACK AND HOLD CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
Hold Capacitance		50	100	220	nF
Settling Time		200	300	600	usec

A/D CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
A/D resolution			10		Bits
A/D conversion time	OSC Frequency dependent				
A/D linearity			1		LSB
A/D FSR				3.6	Volt

CURRENT DRIVE CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
Current Rise Time		500			ns
Current fall Time		500			ns
Current	Operating	2.0		30.0	mA
Current Turn ON time	To 90% of max			25.0	us
Current Turn OFF time	To 10% of max			25.0	us

SENSED CURRENT OR FEEDBACK CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
Input sense current			25.0	500.0	uA

Availability and options for applications:

The LFAFE device is available either as packaged devices or die for COB mounting.

FIG. 2-18h

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For a full custom application the LFAFE device can be integrated as a custom device with a 'HC05 micro-controller to generate a new device. This is a full custom development option at the customer's request only.

Typical Applications: 3-D graphics input device, 3-D game controllers, serial input devices, appliances, sensor interfaces, smart lighting, toys and games.

FIG 2-18i

WRIST OR ANKLE CONTINUITY STRAP DESIGN

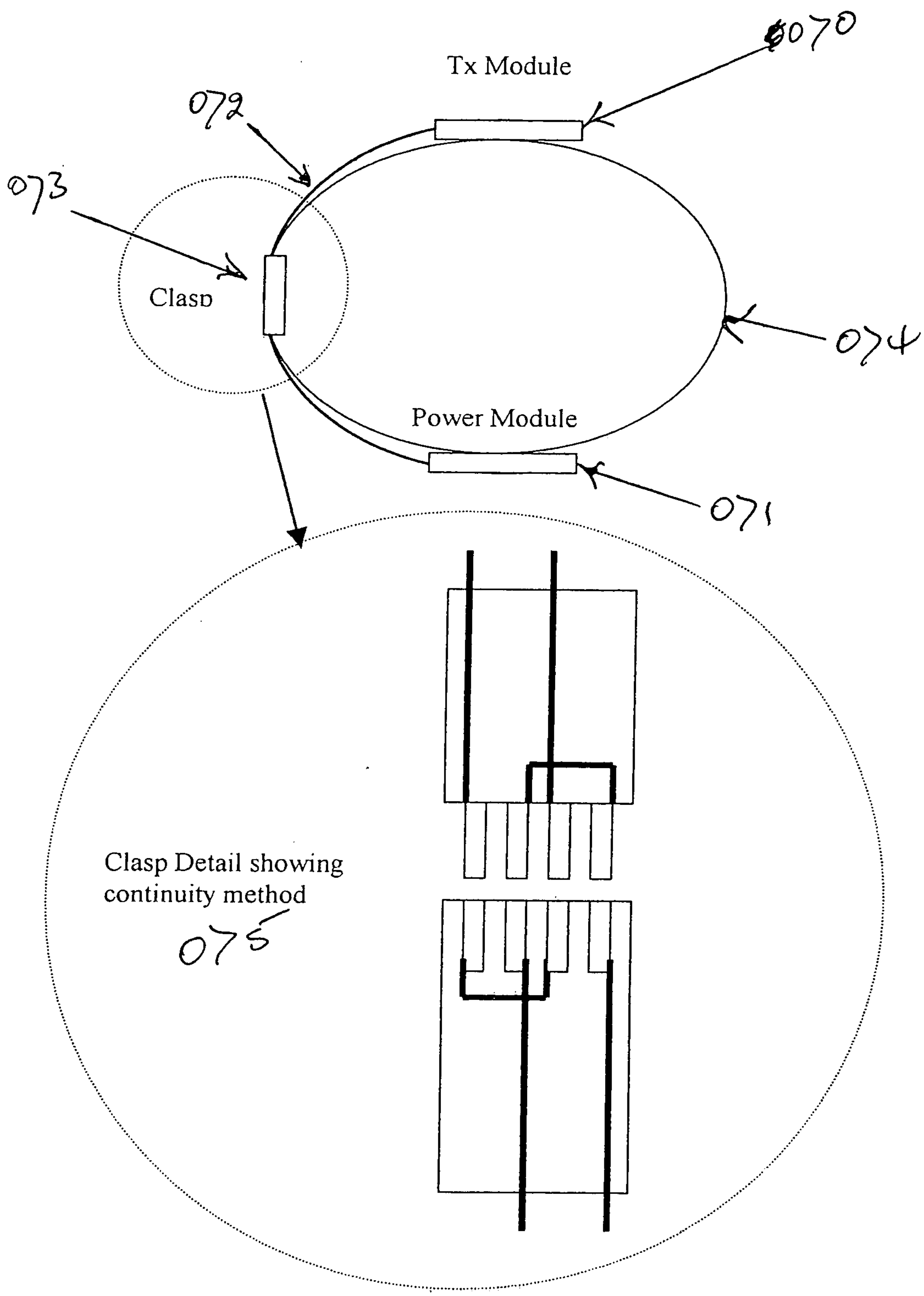


FIG. 2-19

HOME MONITOR LAYOUT

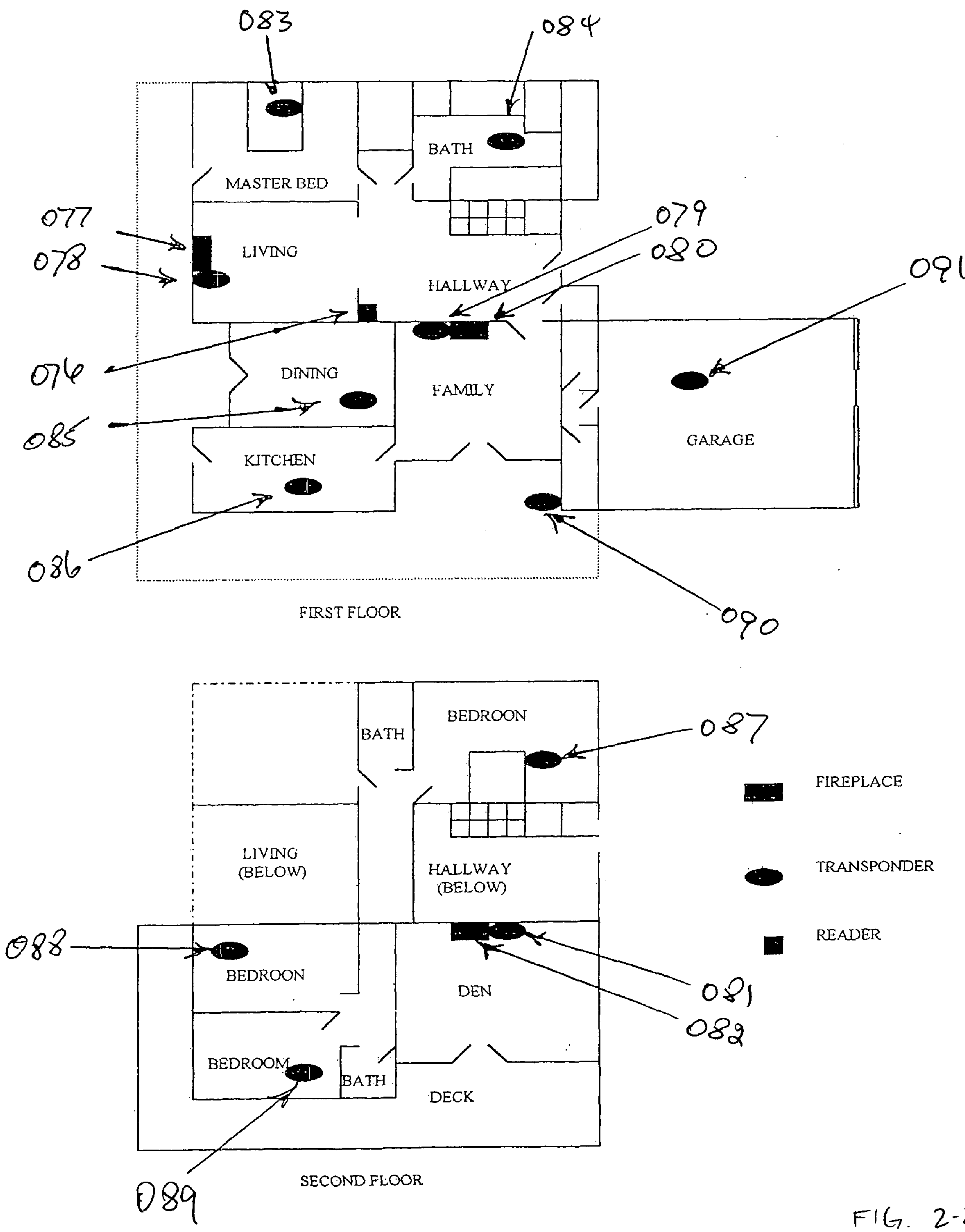


FIG. 2-20

RadioData Corporation

7-ELEMENT YAGI ANTENNA SPECIFICATIONS

1.0 Introduction & Scope

This specification applies to a High Gain Yagi Antenna that provides the ability to extend the range of the RadioData Reader to cover large areas.

2.0 Product Overview

The 7-element Yagi antenna provides high gain for large area coverage and needs to be used in orthogonally mounted pairs in order to provide the necessary diversity to minimize the read range variability that otherwise will occur with random tag orientation. Read Ranges can be in excess of 800 feet with Spider Tags in a line of sight, open field environment.

The low profile and "EverSealed" feed reduces the vulnerability of the antenna to the impact of a harsh environments and the computer-optimized design combines maximum performance with survivability, resulting in outstanding durability.

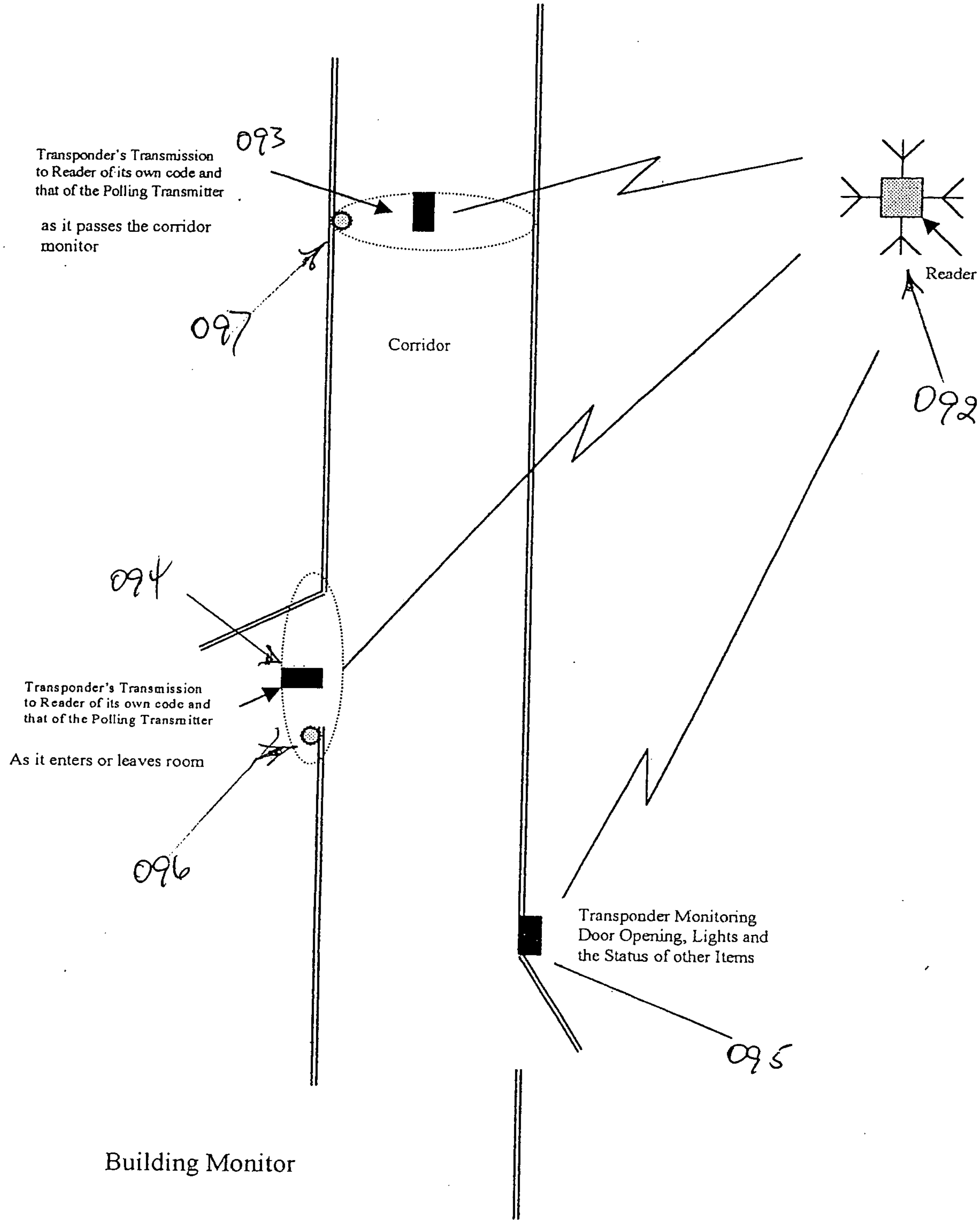
3.0 Specifications

Frequency Range:	290 to 310 MHz
Gain	9 dBd minimum
Front to Back Ratio	18 dB minimum
VSWR (50 ohms)	1.2:1 typical
Bandwidth (1.5:1)	20 MHz minimum
Beamwidth (3dB)	E Plane 49°, H Plane 60°
Stacking Distance	E Plane 39.5", H Plane 32.5"
Termination:	1 foot, RG58 coax with N-type male connector
Material:	Aluminum
Boom Length:	4.2 feet
Mast (mount) Diameter:	1.25 to 2.00"
Wind Surface Area:	0.4 sq. feet
Wind Survival:	125 mph
Weight:	2.25 lbs

4.0 Available Accessories

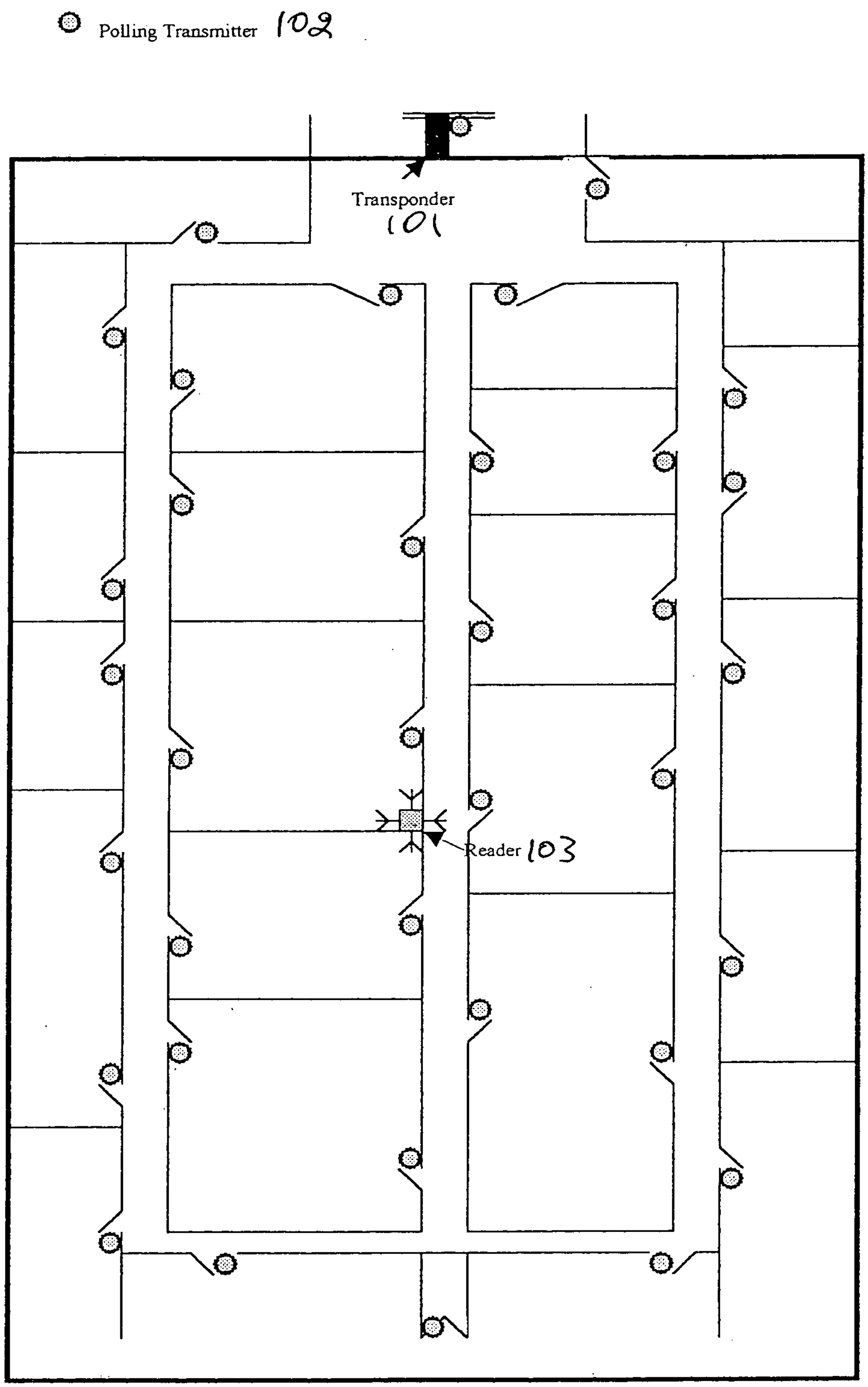
The antenna comes with all necessary mounting hardware. A kit includes two antennae with two 15' RG58 coax cables having SMA and N-type connectors,

FIG. 2-21



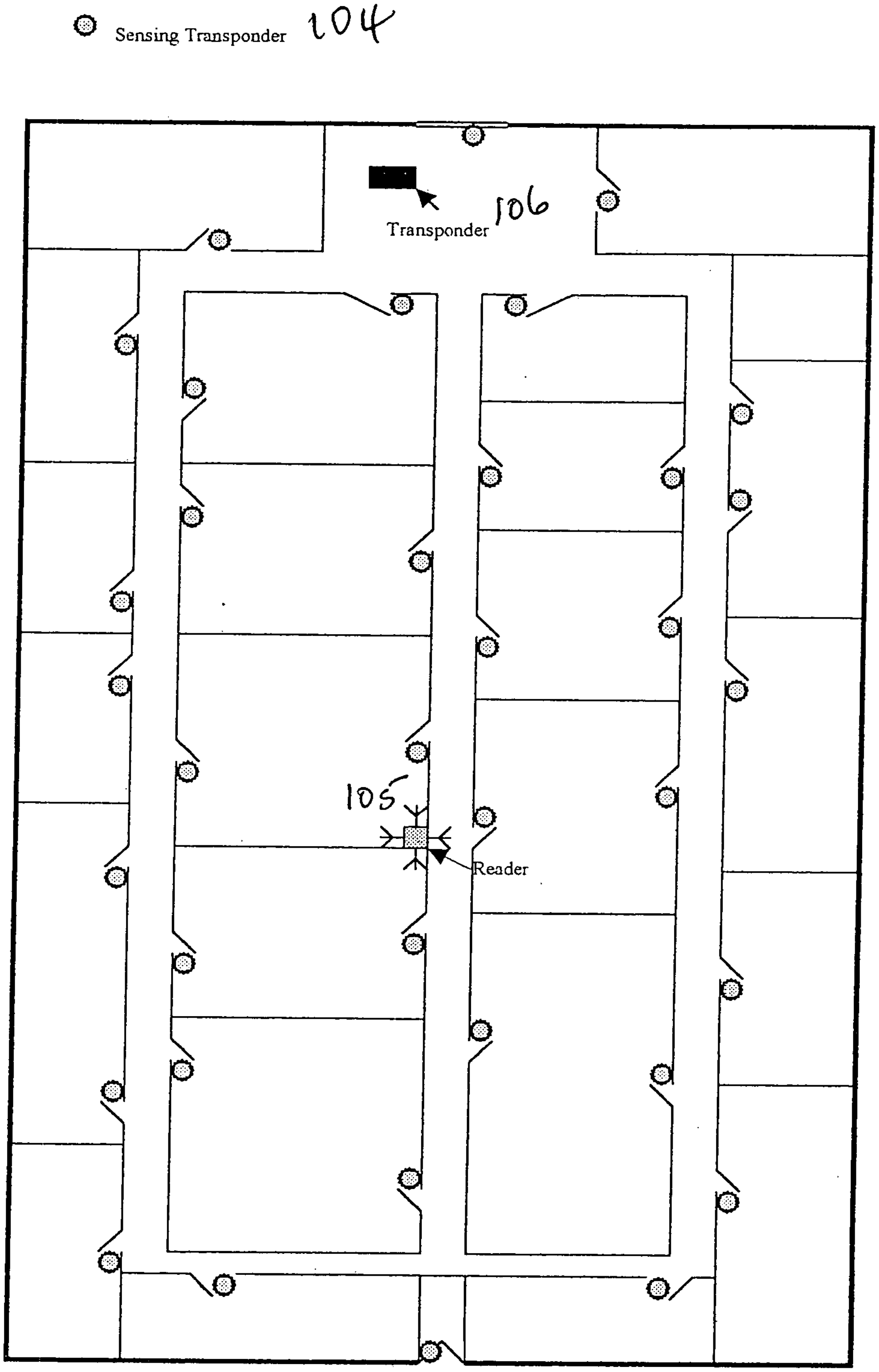
093
Transponder's Transmission to Reader of its own code and that of the Polling Transmitter
as it passes the corridor monitor
097
Corridor
Reader
092
094
Transponder's Transmission to Reader of its own code and that of the Polling Transmitter
As it enters or leaves room
096
Transponder Monitoring Door Opening, Lights and the Status of other Items
095
Building Monitor

FIG. 2-22



Location by Short-range Coded Polling of Transponders

FIG 2-23



Status of Doors, Lights , etc.

FIG 2-24

rdc_trans.sch-1 - Mon Nov 18 21:54:51 2002

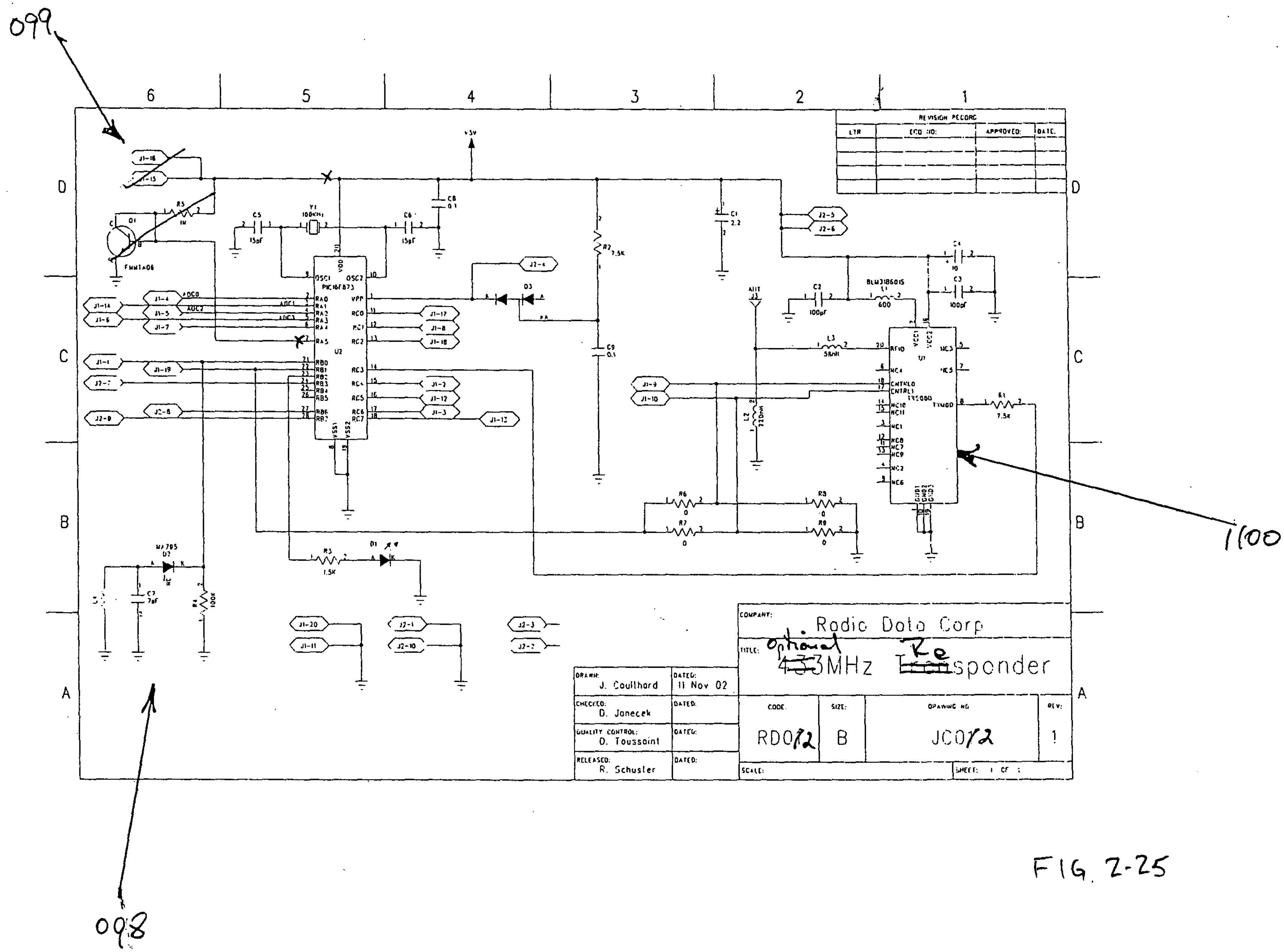


FIG. 2-25

RadioData Corporation	LITMIS SENSOR STATUS REPORT	Model DTO 10021
Change from Prior Report	**Transponder Not Reporting (last status)**	Sensing of Door Status

	TRANSPONDER CODE Group	Individual	SENSOR A	SENSOR B	SENSOR C	SENSOR D	SENSOR E
01	ADFJ-1	132658	Open	Closed	Closed	Open	Open
02	ADFJ-1	132659	Open	Open	Open	Open	Open
03	ADFJ-1	132660	Closed	Closed	Open	Open	**Open**
04	ADFJ-1	132661	Closed	Open	Closed	Open	Open
05	ADFJ-1	132662	Open	Open	**Closed**	Closed	Open
06	ADFJ-1	132663	Open	Open	**Open**	Open	Closed
07	ADFJ-1	132664	**Open**	Closed	Open	Open	Open
08	ADFJ-1	132665	Open	Closed	Closed	Open	Open
09	ADFJ-1	132666	Closed	Closed	Open	Closed	Open
10	ADFJ-1	132667	Open	Open	Open	Closed	Closed
11	ADFJ-2	132745	Open	Open	Open	Closed	**Closed**
12	ADFJ-2	132746	Open	**Closed**	Closed	Open	Closed
13	ADFJ-2	132747	Closed	Closed	Closed	Closed	**Open**
14	ADFJ-2	132748	Closed	Open	Closed	Open	Open
15	ADFJ-2	132749	Closed	Open	Open	Open	Open
16	ADFJ-2	132750	Closed	Open	Open	**Open**	Closed
17	ADFJ-2	132751	Closed	**Open**	Closed	Closed	Open
18	ADFJ-2	132752	Closed	Closed	Closed	Closed	Open
19	**ADFJ-2**	**132753**	**Open**	**Closed**	**Open**	**Closed**	**Open**
20	ADFJ-2	132754	Closed	Closed	Open	Open	Closed

Report AC-10235	Date June 14, 2003	Time 12:45 am	Satust Beta Test 2A

FIG. 2-26

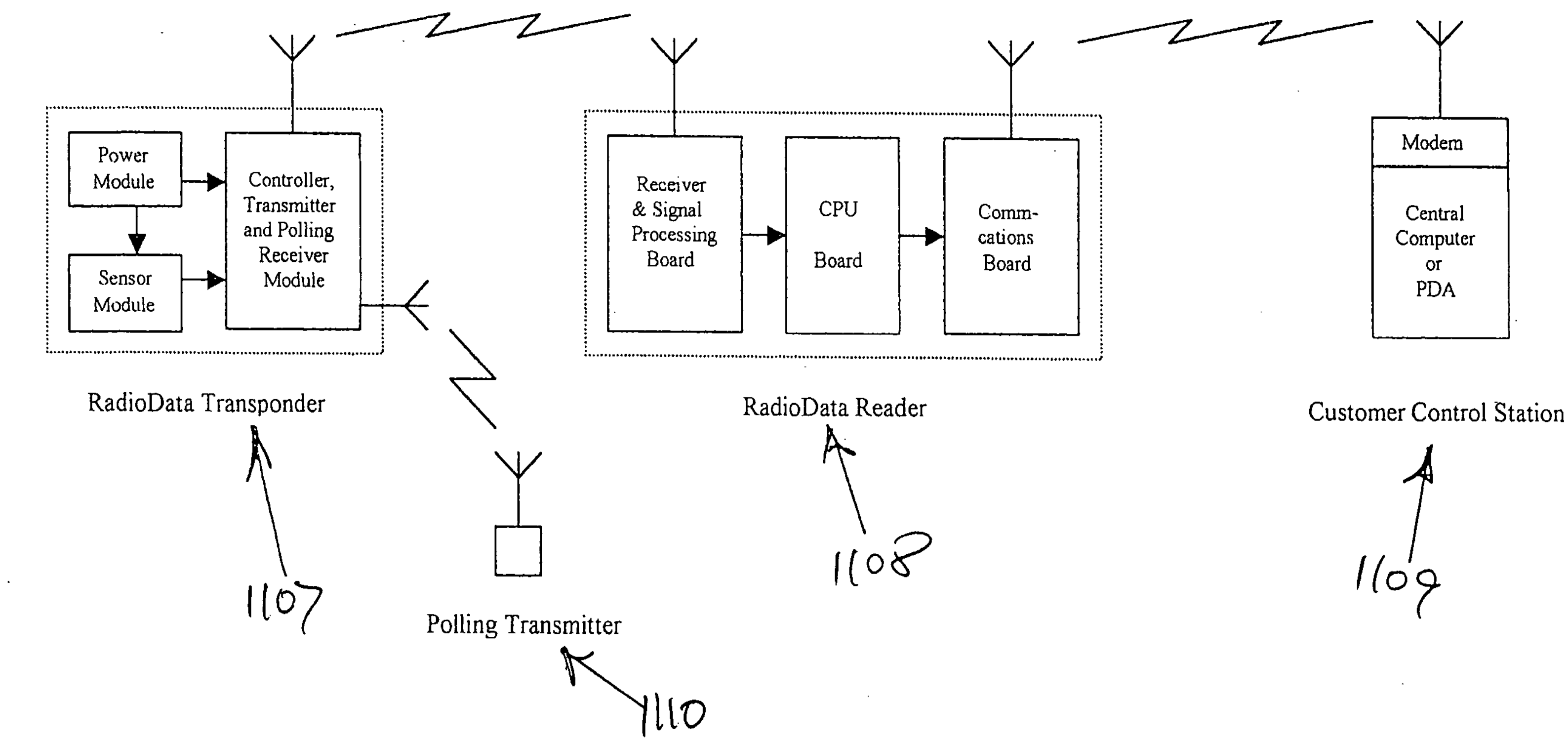

Power Module
Sensor Module
Controller, Transmitter and Polling Receiver Module
RadioData Transponder
1107
Polling Transmitter
1110
Receiver & Signal Processing Board
CPU Board
Comm-cations Board
RadioData Reader
1108
Modem
Central Computer or PDA
Customer Control Station
1109

FIG. 2-27.

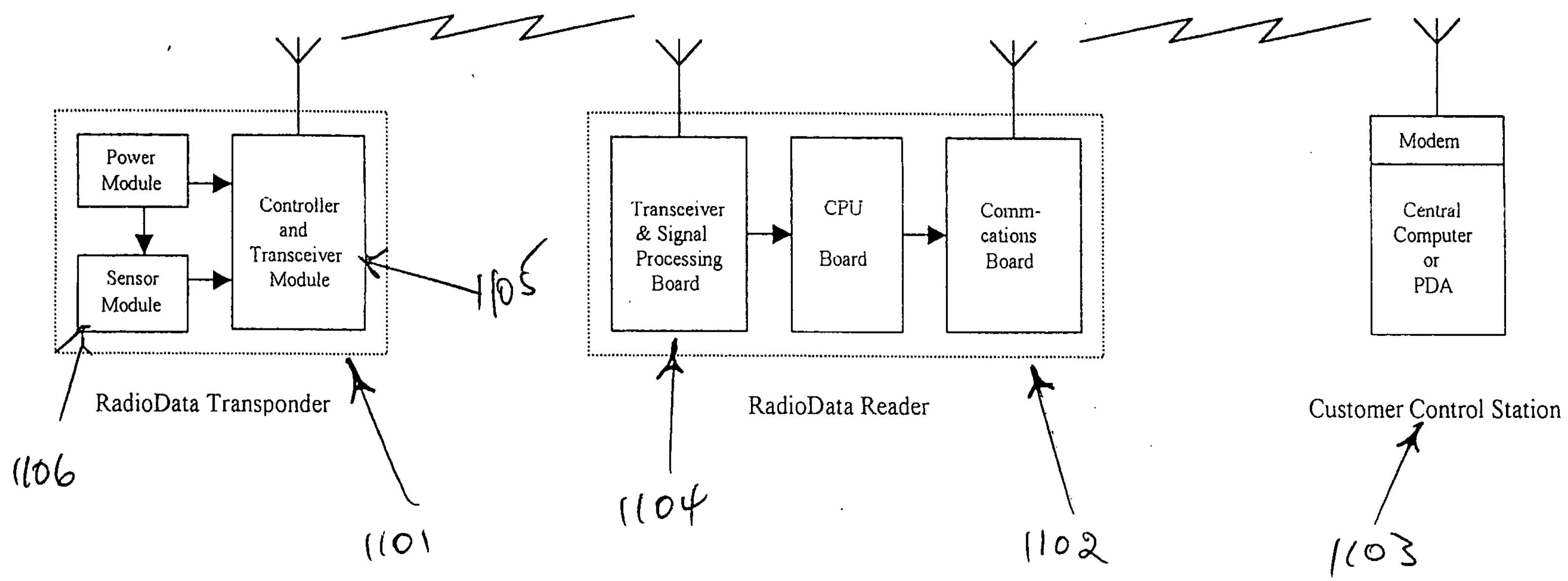

Power Module
Sensor Module
Controller and Transceiver Module
1105
RadioData Transponder
1106
1101
Transceiver & Signal Processing Board
CPU Board
Comm-cations Board
RadioData Reader
1104
1102
Modem
Central Computer or PDA
Customer Control Station
1103

FIG. 2-28

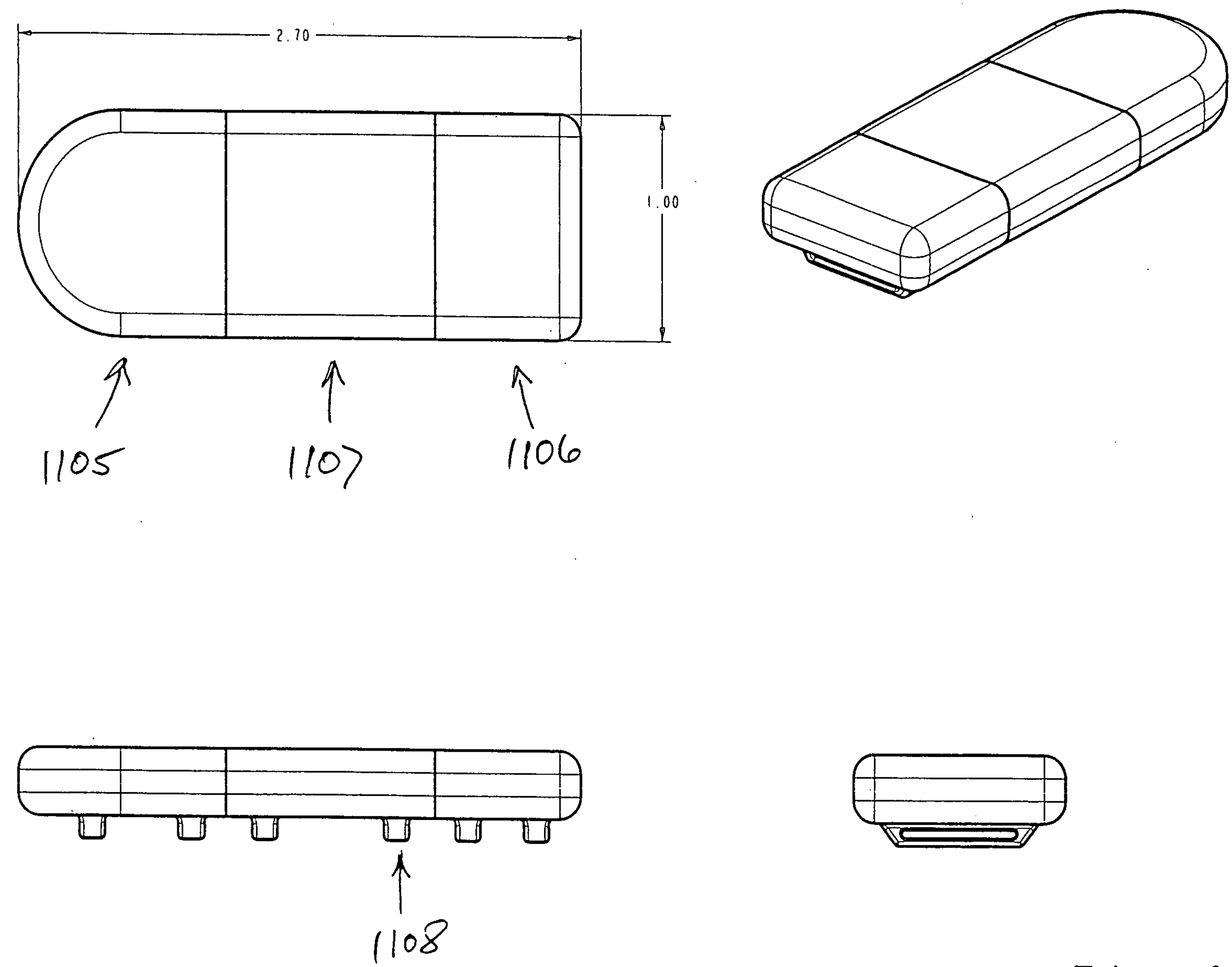
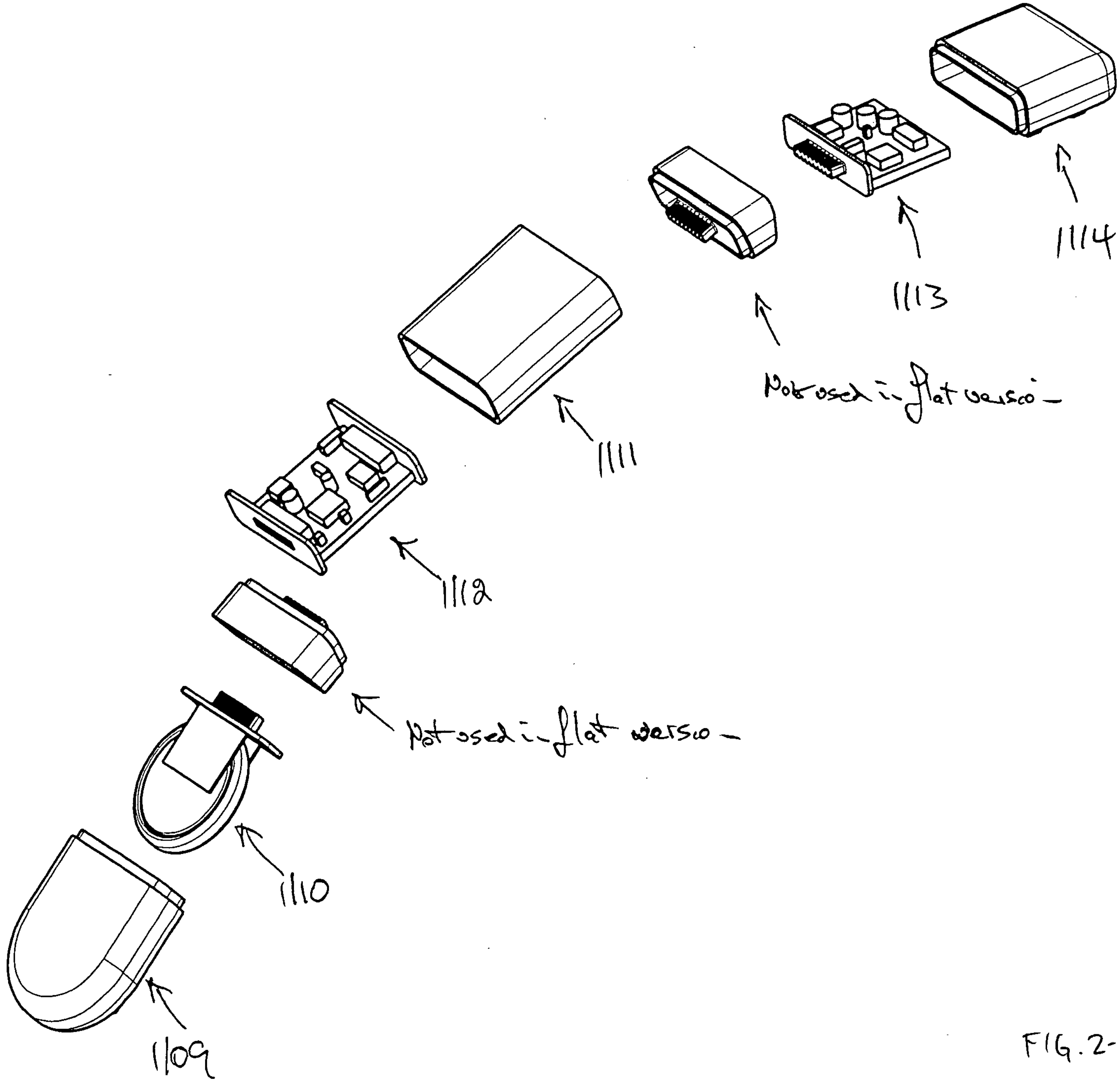


FIG. 2-29



1114
1113
Not used in flat version
1111
1112
Not used in flat version
1110
1109

FIG. 2-30

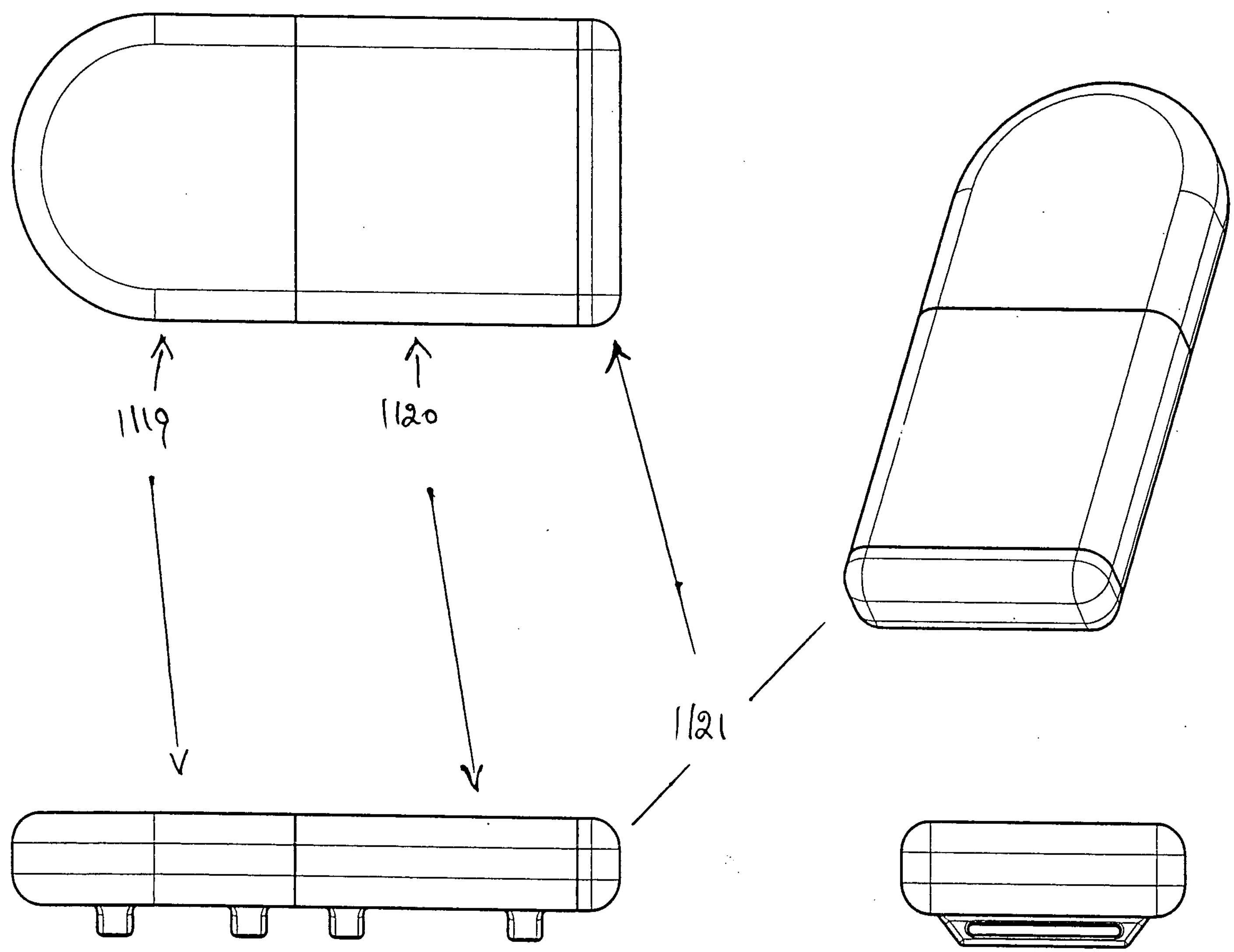


FIG. 2-31

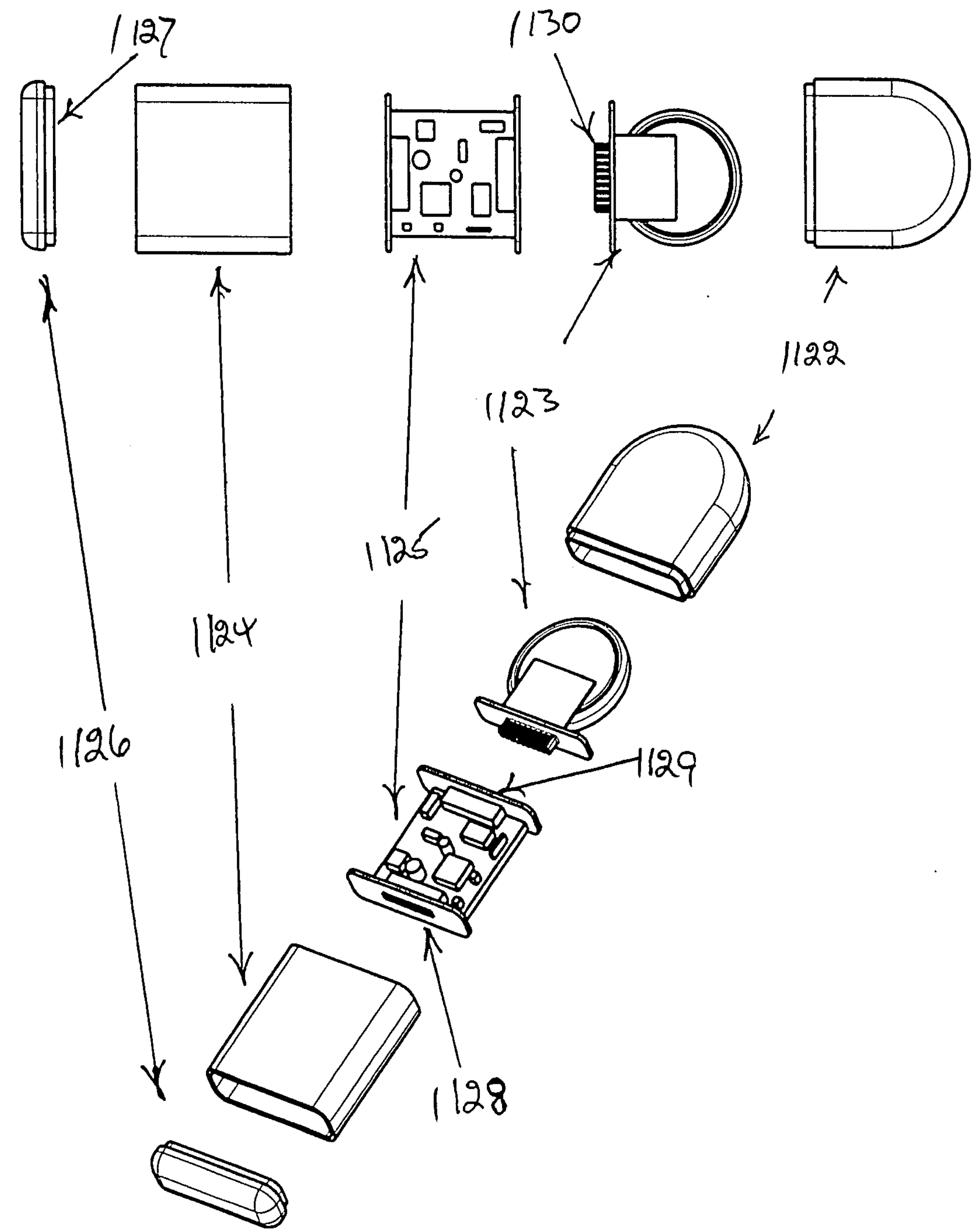


FIG. 2-32

ASH Transceiver Block Diagram

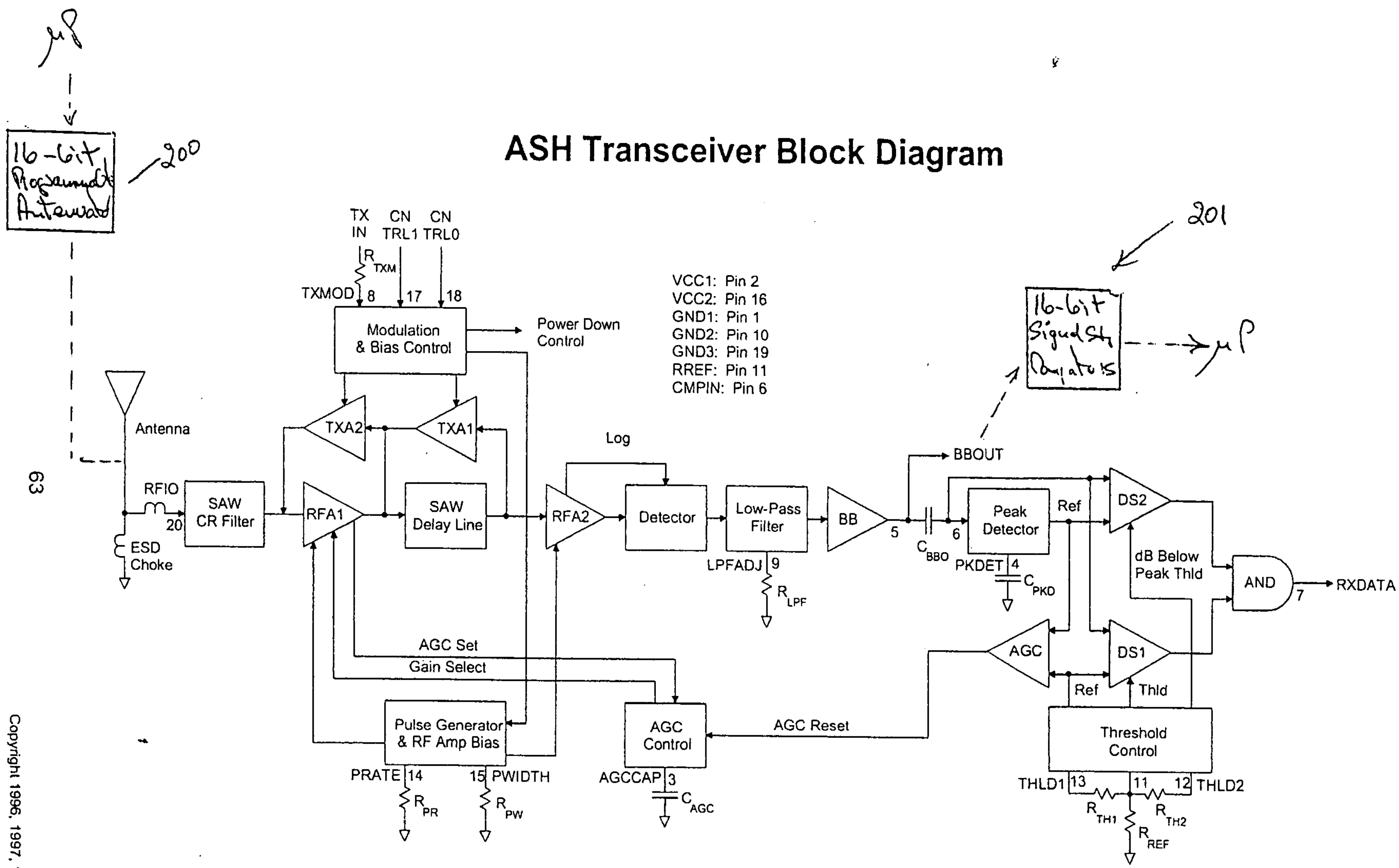


FIG 2-33

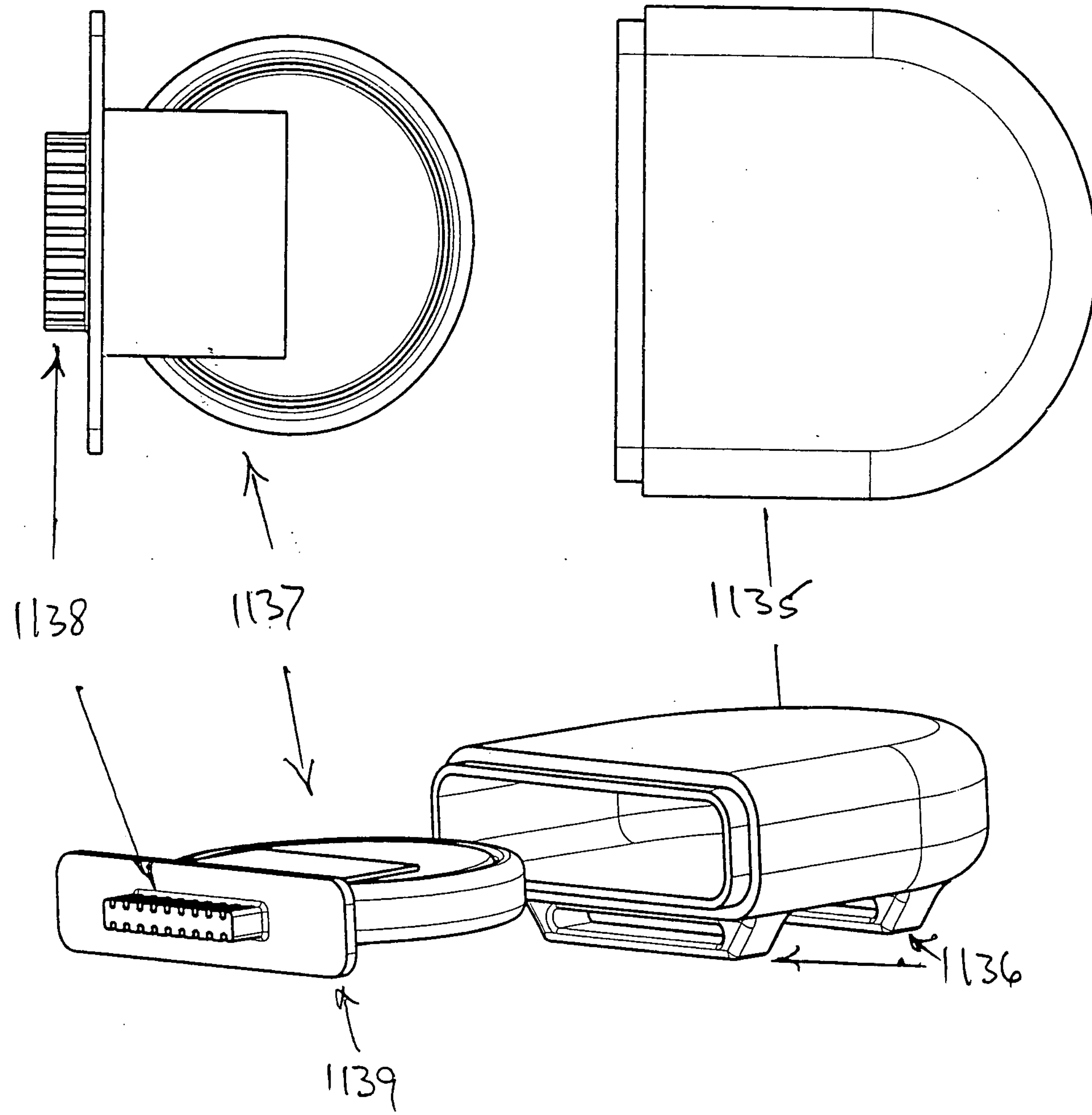


FIG. 2-34

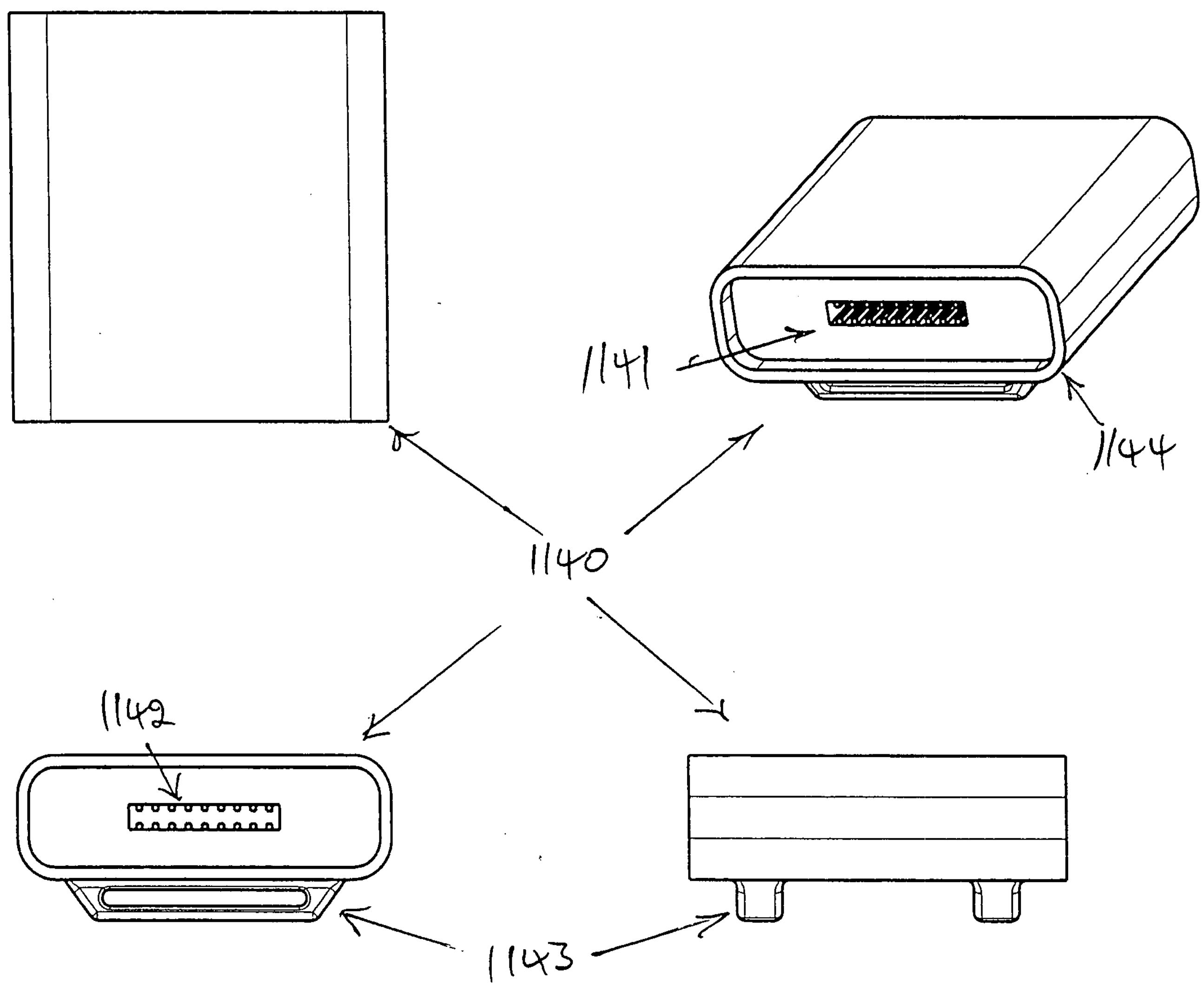


FIG. 2-35

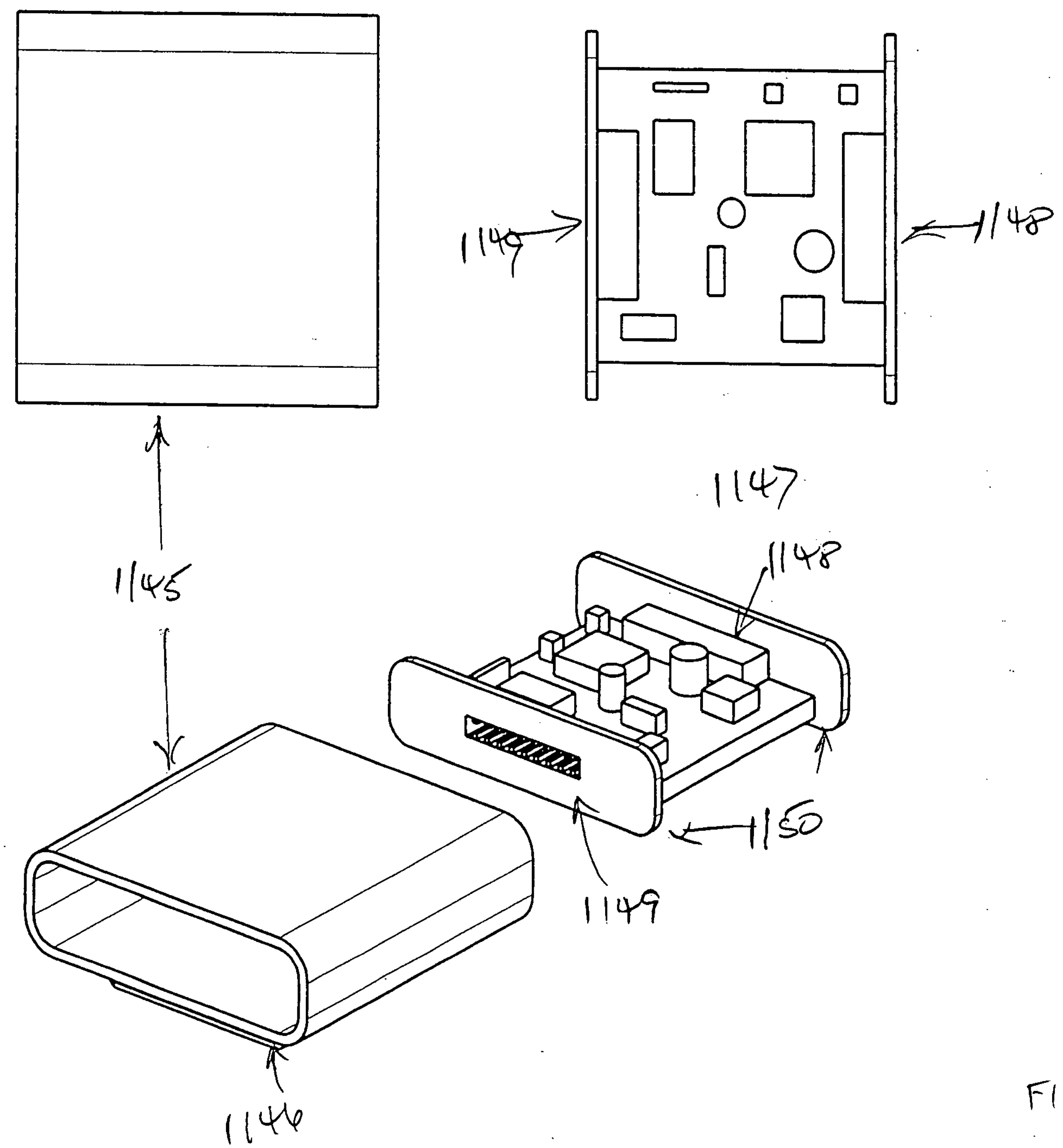


FIG. 2-36

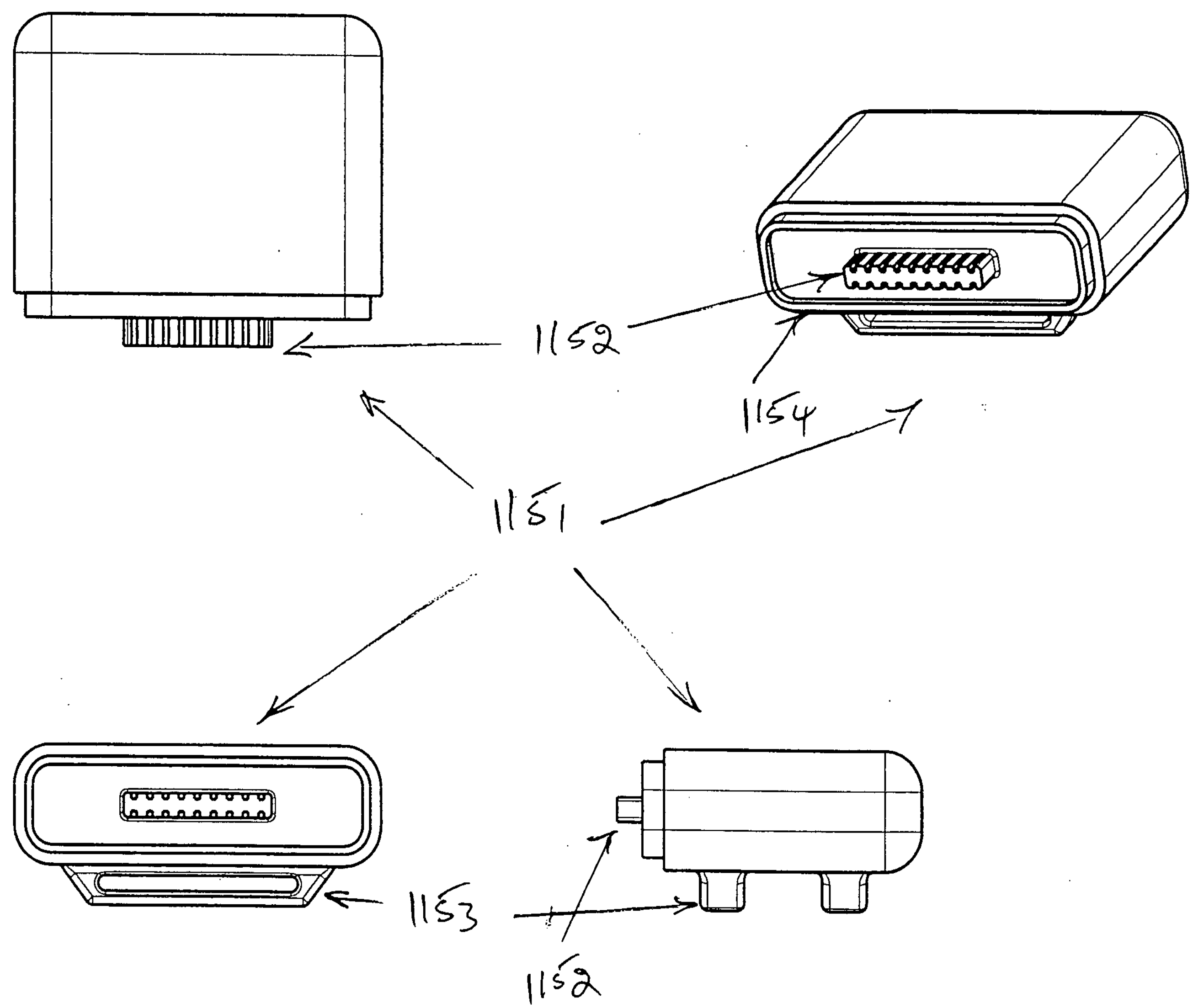


FIG. 2-37

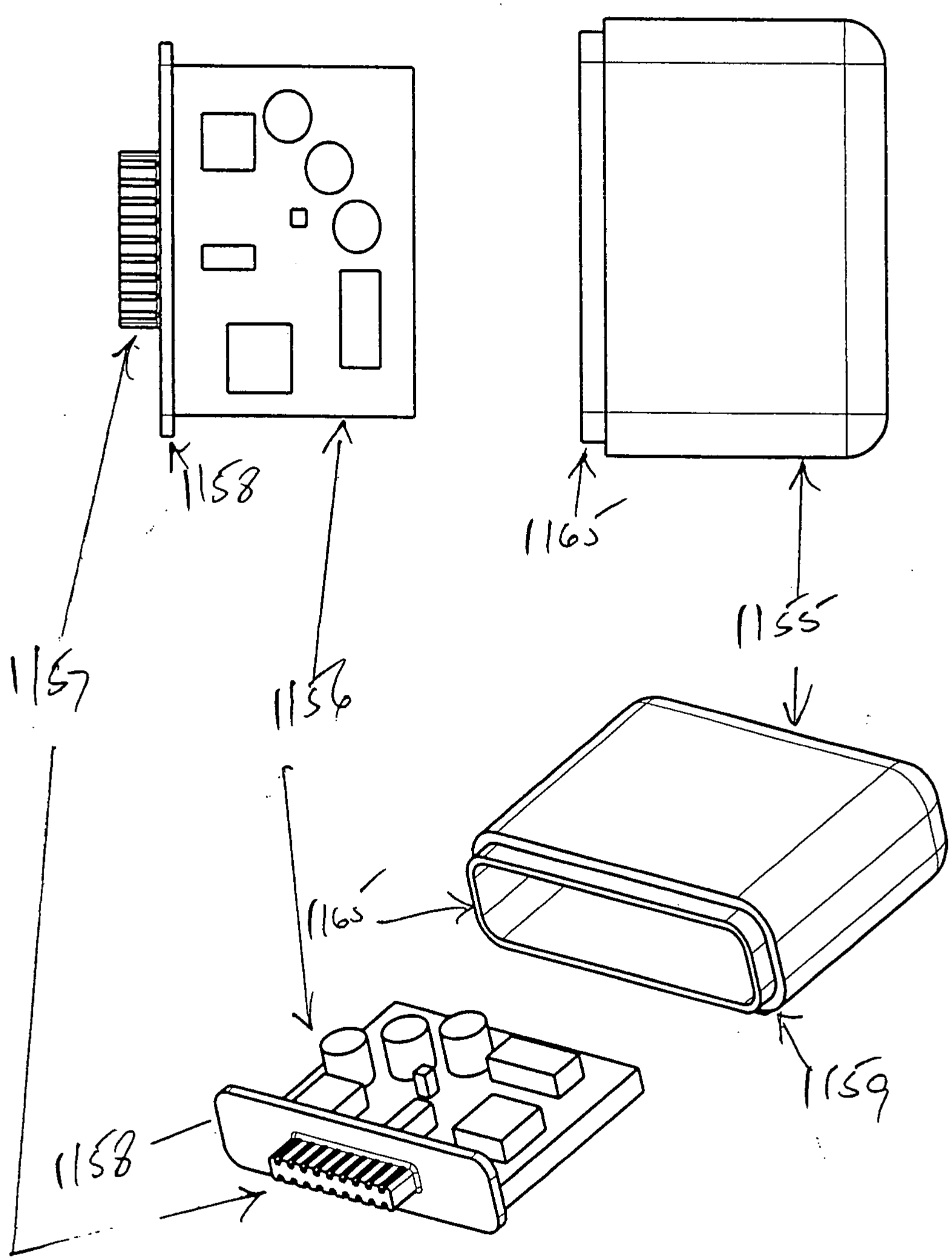


FIG. 2-38

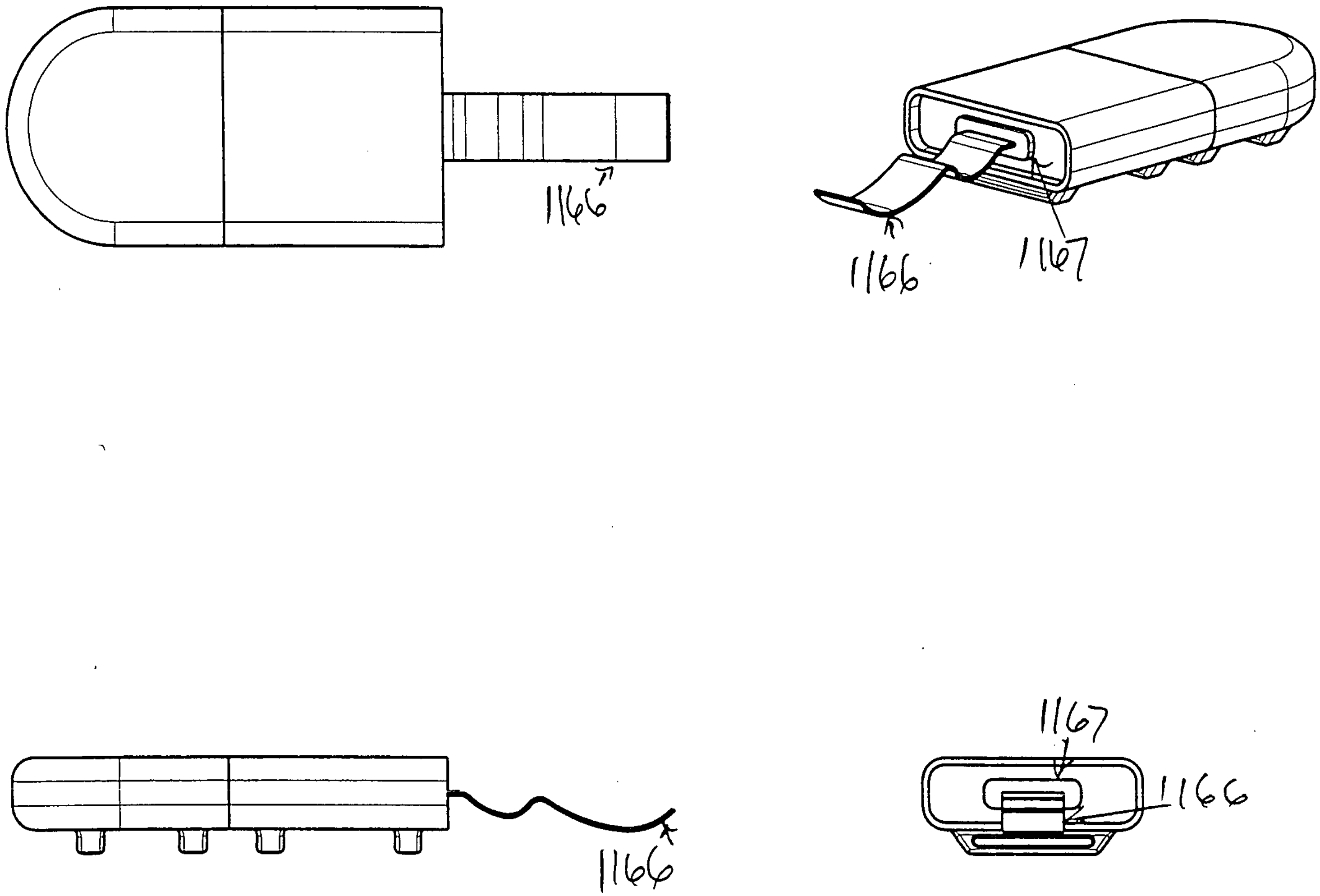


FIG. 2-39

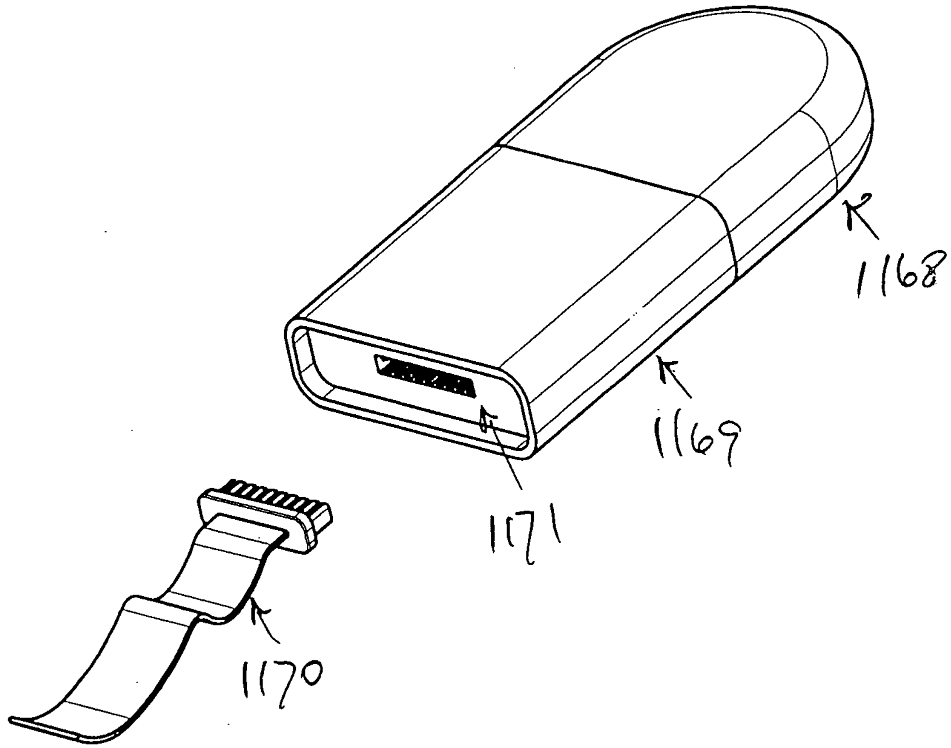


FIG. 2-40

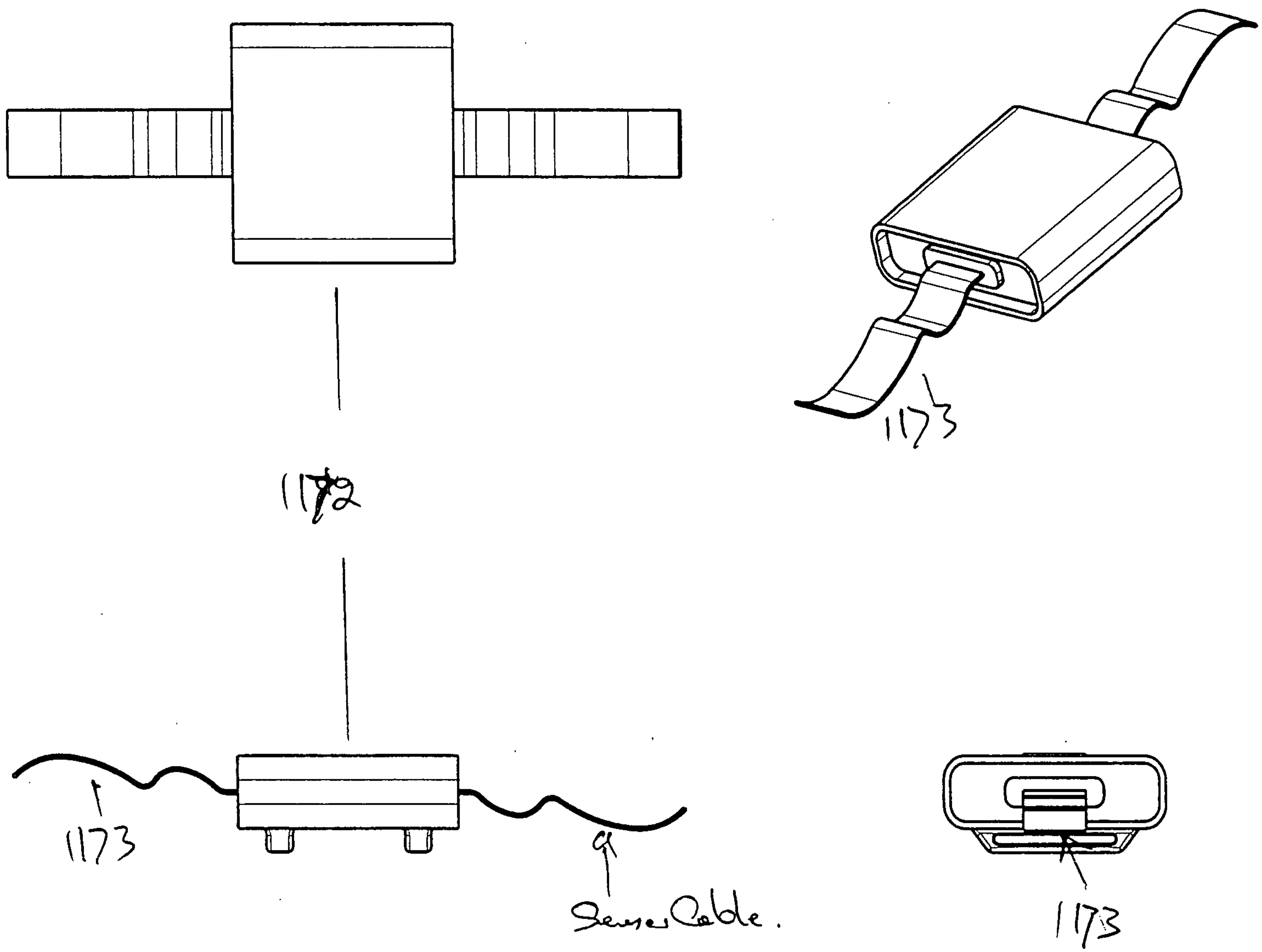


FIG. 2-41

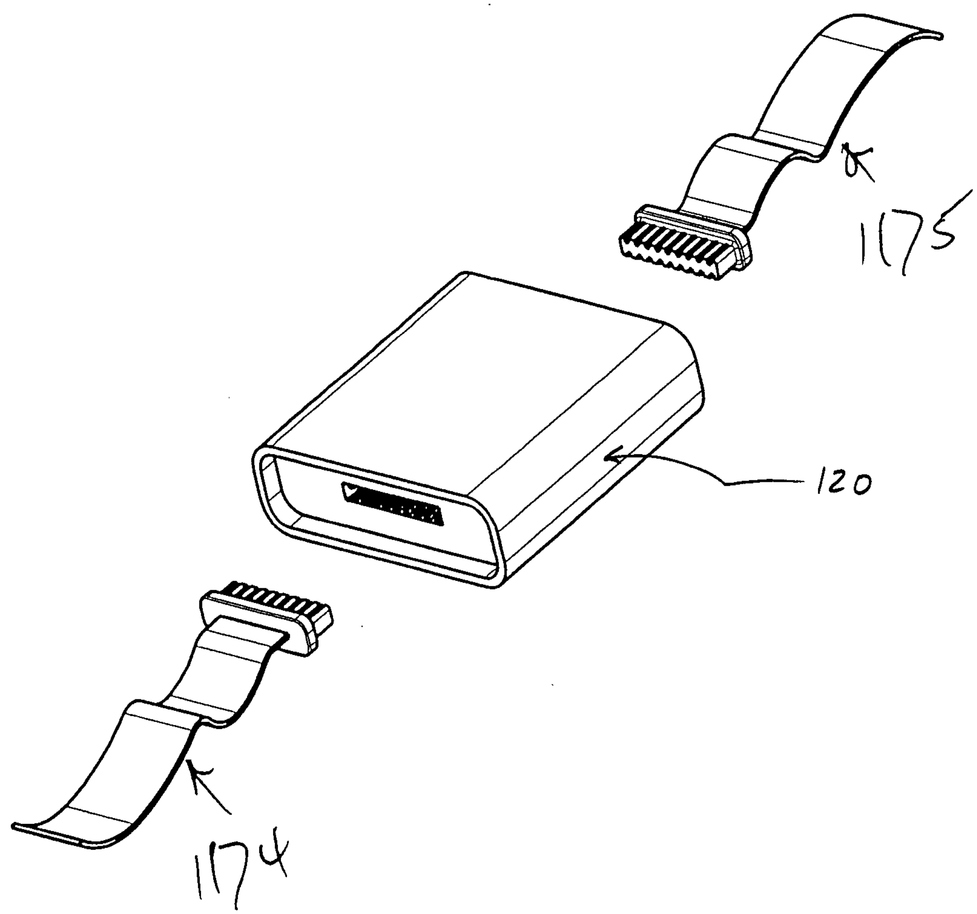


FIG. 2-42

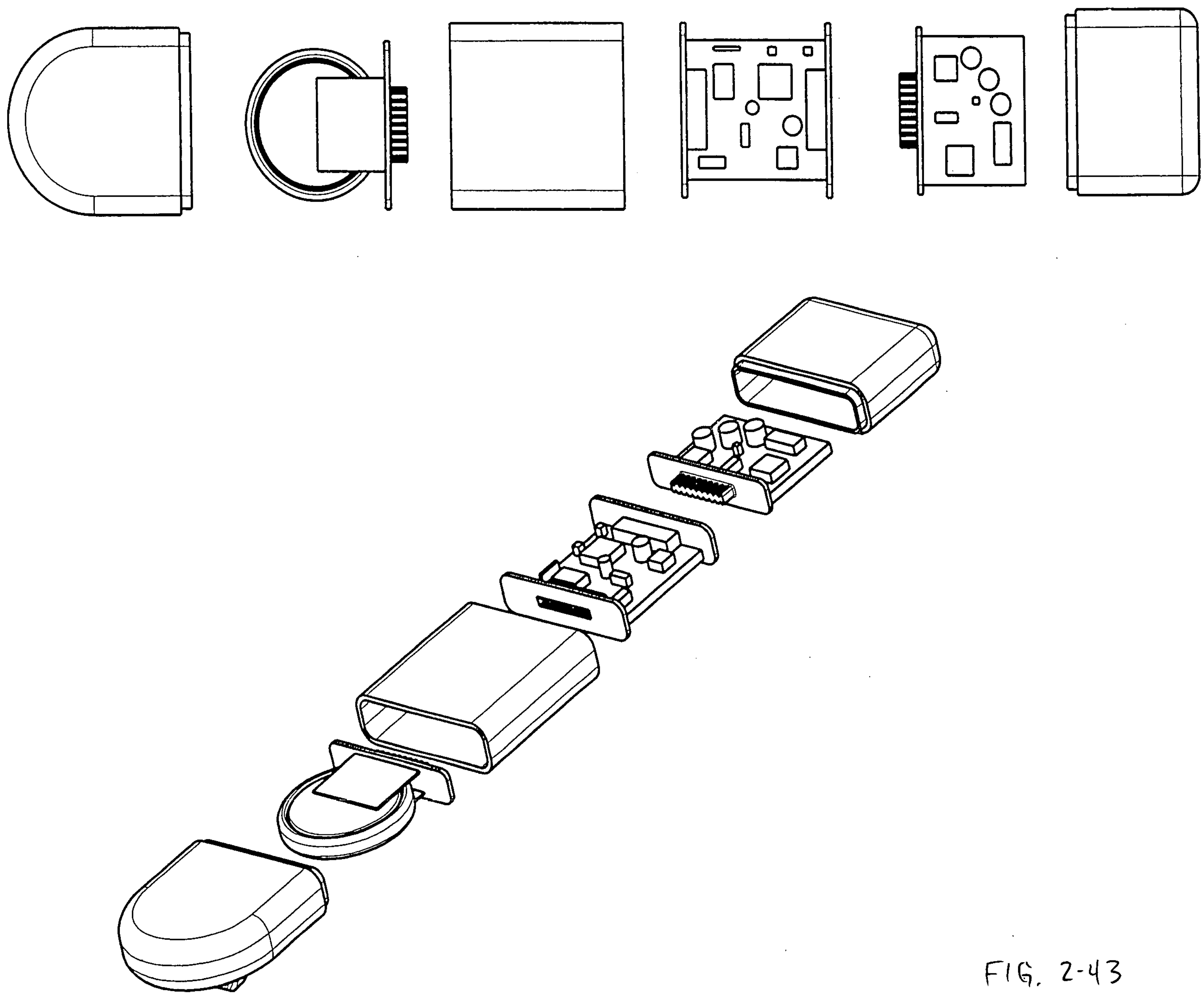


FIG. 2-43

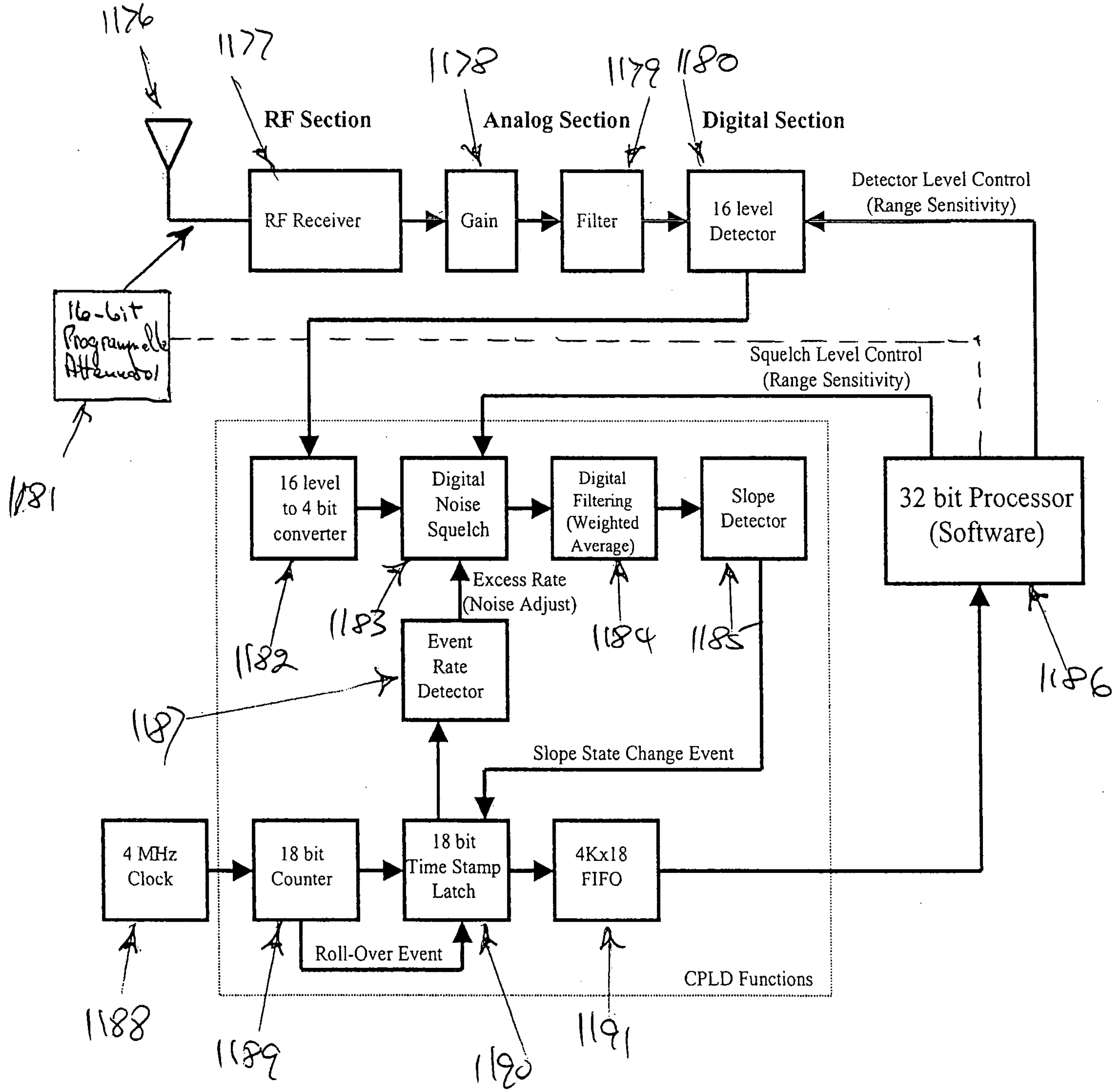

1176
1177
1178
1179
1180
RF Section
Analog Section
Digital Section
RF Receiver
Gain
Filter
16 level Detector
Detector Level Control (Range Sensitivity)
16-bit Programmable Attenuator
Squelch Level Control (Range Sensitivity)
1181
16 level to 4 bit converter
Digital Noise Squelch
Digital Filtering (Weighted Average)
Slope Detector
32 bit Processor (Software)
Excess Rate (Noise Adjust)
1182
1183
1184
1185
1186
Event Rate Detector
1187
Slope State Change Event
4 MHz Clock
18 bit Counter
18 bit Time Stamp Latch
4Kx18 FIFO
Roll-Over Event
CPLD Functions
1188
1189
1190
1191

FIG. 2-44

** RF Section **

RF Receiver Section

The RF Receiver consists of a connector for the antenna,
an antenna-receiver impedance matching circuit and a OOK/ASK receive
r.
There are two indentical RF sections per cicuit.

** Analog Section **

Gain Section

The gain section consists of a differential amp and
a summing amp. The differential
amp provides gain and offset adjustment. The summing
amp adds the two(1 per receiver) signals together.

Filter Section

The filter section consists of an active filter.
The active filter reduces signal noise.

16 Level Detector

The level detector consists of a 16 level voltage divider,
16 comparators and a upper and lower level voltage adjustment.
The voltage divider provides 16 equally spaced voltage reference lev
els for
the 16 comparators. Each comparators detects if the received
signal is high or lower than its voltage reference. The upper
and lower voltage references are adjusted using a potentiometer.

** CPLD section **

16 level to 4 bit converters

The 16 level to 4 bit converter debounces the incoming bits and
converts the data to a 4 bit binary code.

Digital Squelch

The digital squelch is a function used to set a minimum signal
value. Any signals below the digital squelch level are ignored.

Digital Filtering

FIG. 2-44a

The digital filter performs a weighted average on the signal.
Each sample is weighted based on the age of the sample.
The older the sample the less weight a sample has in the average.
This smooths the signal and reduces noise.

Slope Detector

The slope detector looks for slope changes in the signal.
There are currently 3 types of slopes detected (up, down & level).
Any change in slope type is detected and a pulse is sent.

18 bit counter

An 18 bit counter is used to keep a rolling count of the 4MHz clock in a binary format.

Time stamp latch

A time stamp is latched whenever a pulse is latched from the 18 bit counter whenever a pulse is received from the slope detecter. All roll-over events are also latch to aid in tracking event timing.

4K x 18 bit FIFO

All data captured in the time stamp latch is also loaded in the FIFO (First IN First Out) Memory device. The FIFO is used to store time stamps until the micro-processor is ready to read it.

Event Rate Detector

When time stamps occur at a rate that is faster than the known signal rate the event rate detector makes an automatic adjustment to the digital squelch circuit. This effectivley eliminates fast noise signals.

** Micro Processor **

The microprocessor reads data from the FIFO and analyzes the time st
amps
to decode data from the transmitter. The microprocessor also contro
ls
the potentiometers that adjust the upper and lower threshold levels.
The micro processor sets the level in the digital squelch circuit.

FIG. 2-44b

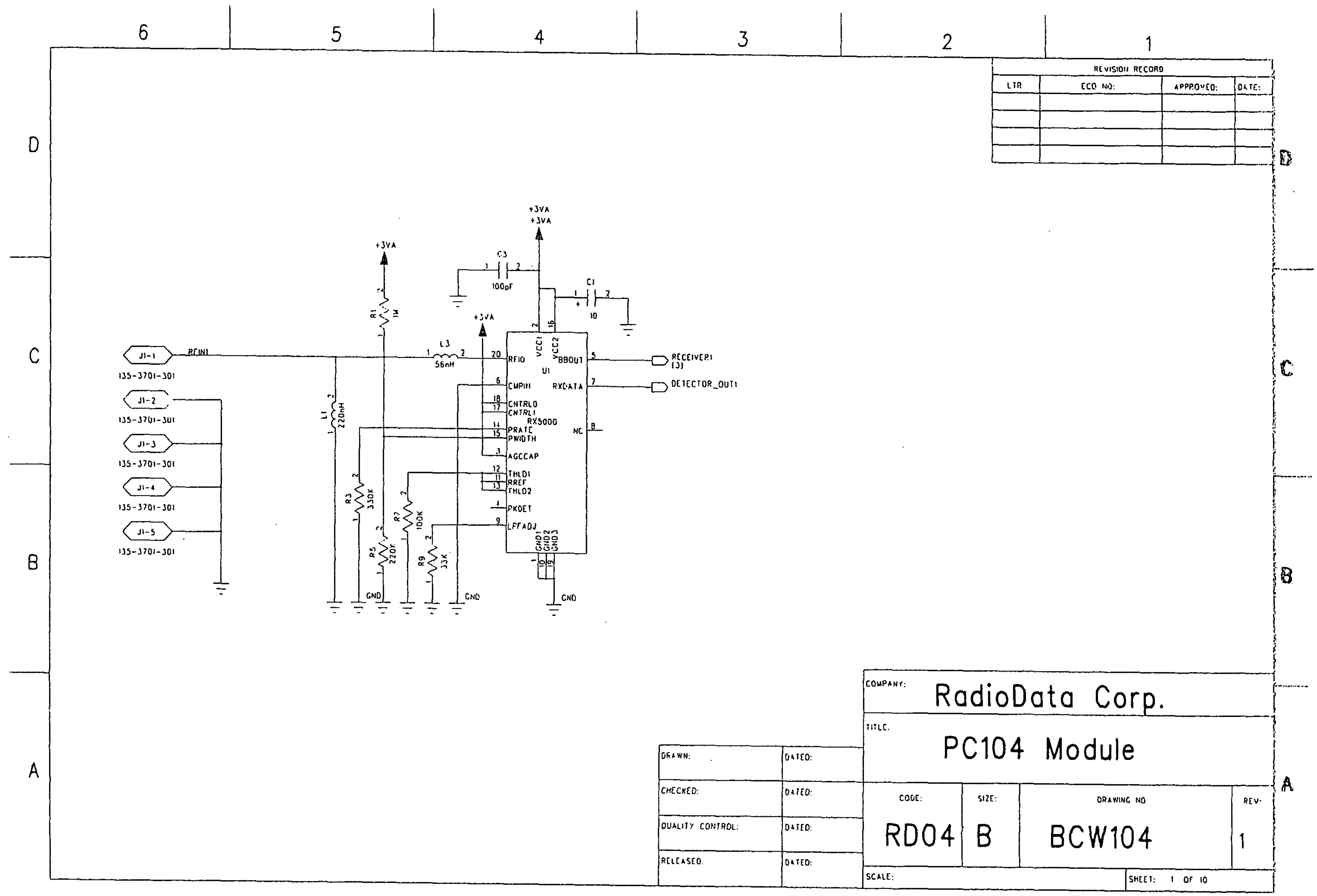

REVISION RECORD
LTR
ECO NO:
APPROVED:
DATE:
+3VA
C3
100pF
C1
10
R1
1M
L3
56nH
L1
220nH
R3
330K
R5
220K
R7
100K
R9
33K
J1-1
RFIN1
135-3701-301
J1-2
135-3701-301
J1-3
135-3701-301
J1-4
135-3701-301
J1-5
135-3701-301
U1
RX5000
VCC1
VCC2
RFIO
CMPIN
CNTRL0
CNTRL1
PRATE
PWIDTH
AGCCAP
THLD1
RREF
THLD2
PKDET
LPFADJ
BBOUT
RXDATA
NC
GND1
GND2
GND3
GND
RECEIVER1 (3)
DETECTOR_OUT1
COMPANY:
RadioData Corp.
TITLE:
PC104 Module
DRAWN:
DATED:
CHECKED:
DATED:
QUALITY CONTROL:
DATED:
RELEASED:
DATED:
CODE:
RD04
SIZE:
B
DRAWING NO
BCW104
REV:
1
SCALE:
SHEET: 1 OF 10

FIG. 2-45

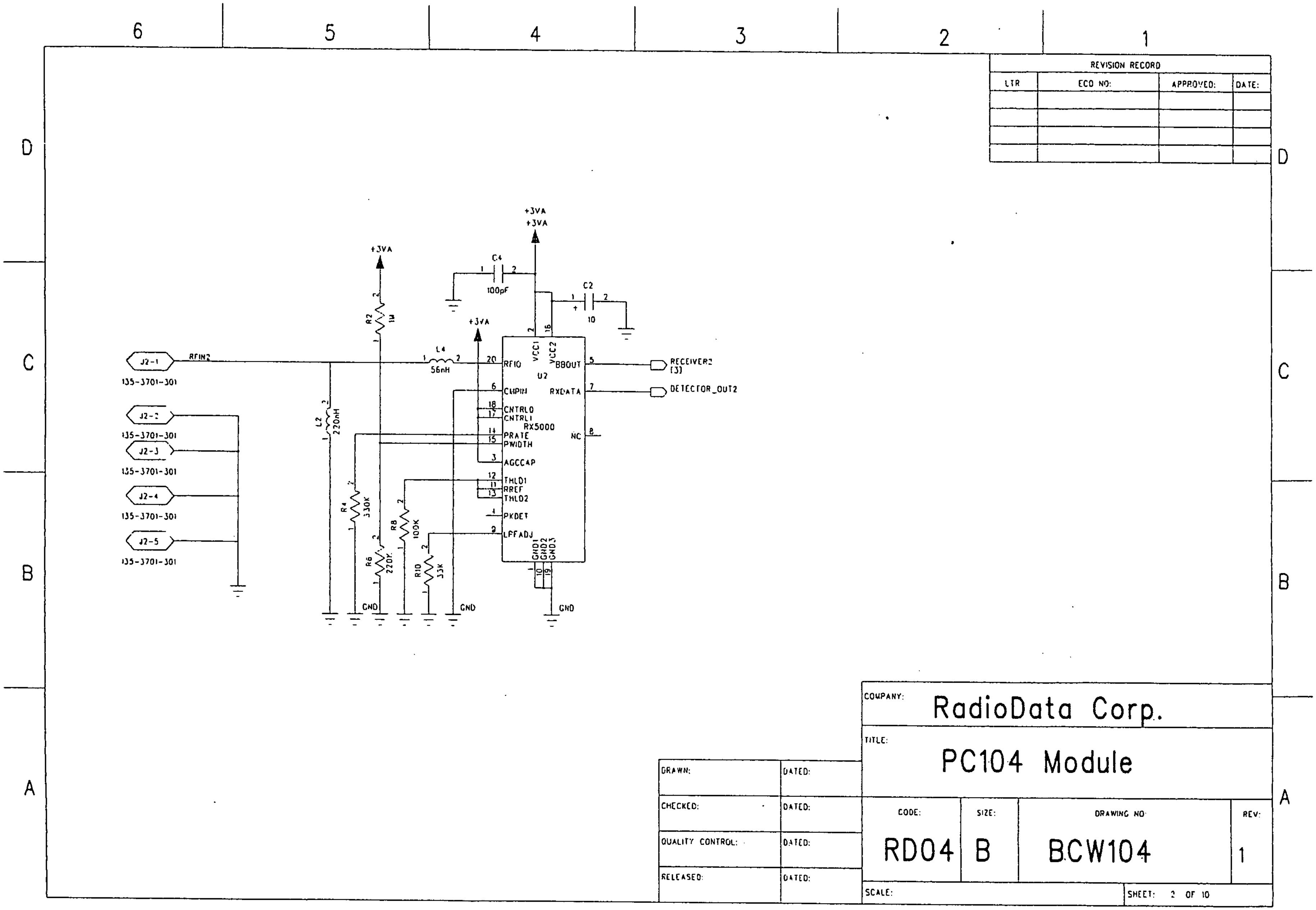
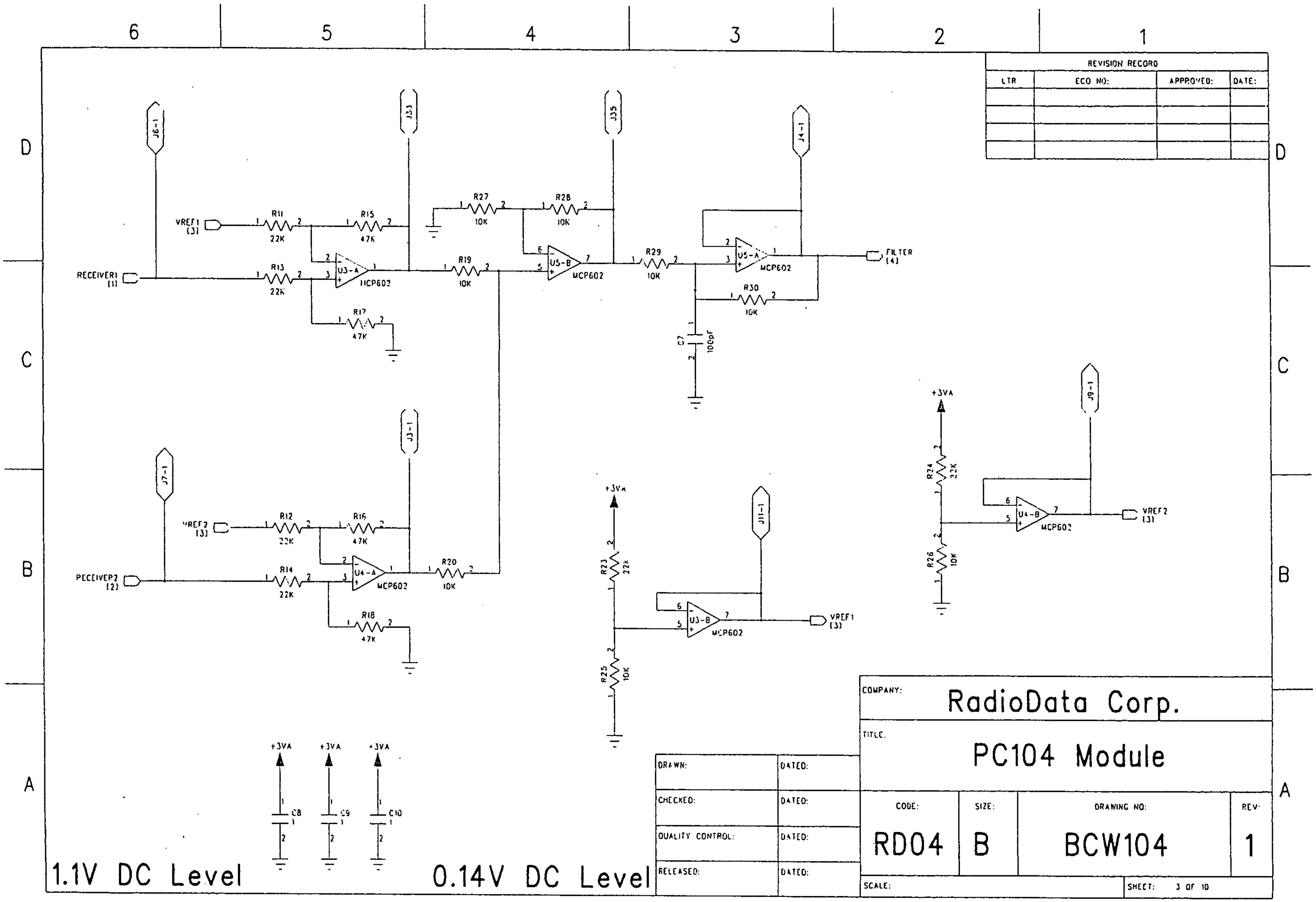

6
5
4
3
2
1
D
C
B
A
REVISION RECORD
LTR
ECO NO:
APPROVED:
DATE:
+3VA
+3VA
+3VA
+3VA
C4
100pF
C2
10
R2
1M
L4
56nH
RFIN2
J2-1
135-3701-301
J2-2
135-3701-301
J2-3
135-3701-301
J2-4
135-3701-301
J2-5
135-3701-301
L2
220nH
R4
330K
R6
220K
R8
100K
R10
33K
GND
GND
GND
RFIO
VCC1
VCC2
BBOUT
U2
CMPIN
RXDATA
CNTRL0
CNTRL1
RX5000
PRATE
PWIDTH
NC
AGCCAP
THLD1
RREF
THLD2
PKDET
LPFADJ
GND1
GND2
GND3
RECEIVER2
[3]
DETECTOR_OUT2
DRAWN:
DATED:
CHECKED:
DATED:
QUALITY CONTROL:
DATED:
RELEASED:
DATED:
COMPANY:
RadioData Corp.
TITLE:
PC104 Module
CODE:
RD04
SIZE:
B
DRAWING NO:
BCW104
REV:
1
SCALE:
SHEET: 2 OF 10

FIG. 2-46



REVISION RECORD
LTR
ECO NO:
APPROVED:
DATE:
J6-1
J33
J35
J4-1
VREF1 (3)
RECEIVER1 (1)
R11 22K
R13 22K
R15 47K
R17 47K
U3-A
MCP602
R19 10K
R27 10K
R28 10K
U5-B
MCP602
R29 10K
U5-A
MCP602
R30 10K
C7 100pF
FILTER (4)
J3-1
J7-1
VREF2 (3)
RECEIVER2 (2)
R12 22K
R14 22K
R16 47K
R18 47K
U4-A
MCP602
R20 10K
+3VA
R23 22K
R25 10K
U3-B
MCP602
J11-1
VREF1 (3)
+3VA
R24 22K
R26 10K
U4-B
MCP602
J9-1
VREF2 (3)
+3VA
C8
C9
C10
1.1V DC Level
0.14V DC Level
DRAWN:
DATED:
CHECKED:
DATED:
QUALITY CONTROL:
DATED:
RELEASED:
DATED:
COMPANY:
RadioData Corp.
TITLE:
PC104 Module
CODE:
RD04
SIZE:
B
DRAWING NO:
BCW104
REV:
1
SCALE:
SHEET: 3 OF 10

FIG. 2-47

63/111

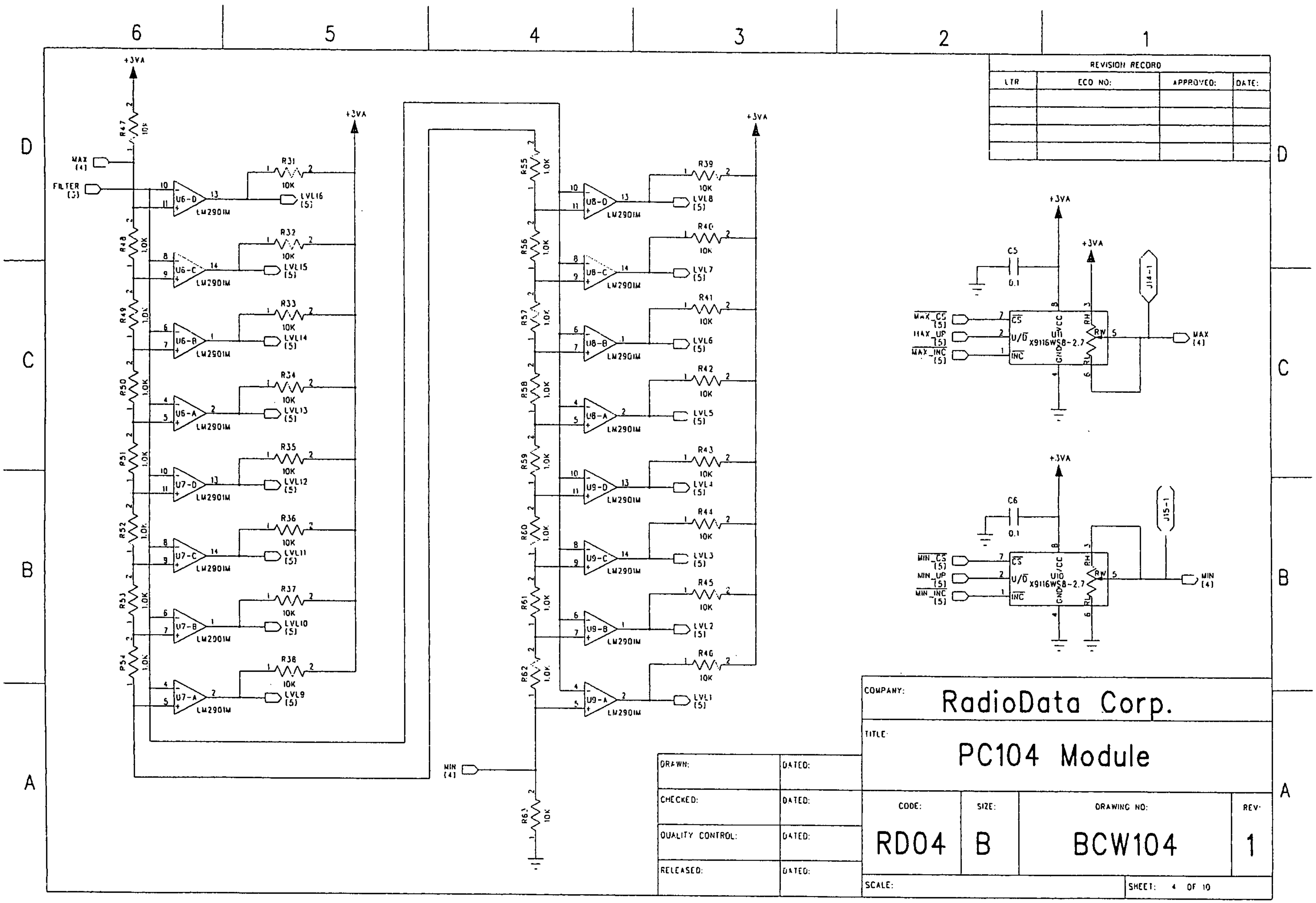


FIG. 2-48

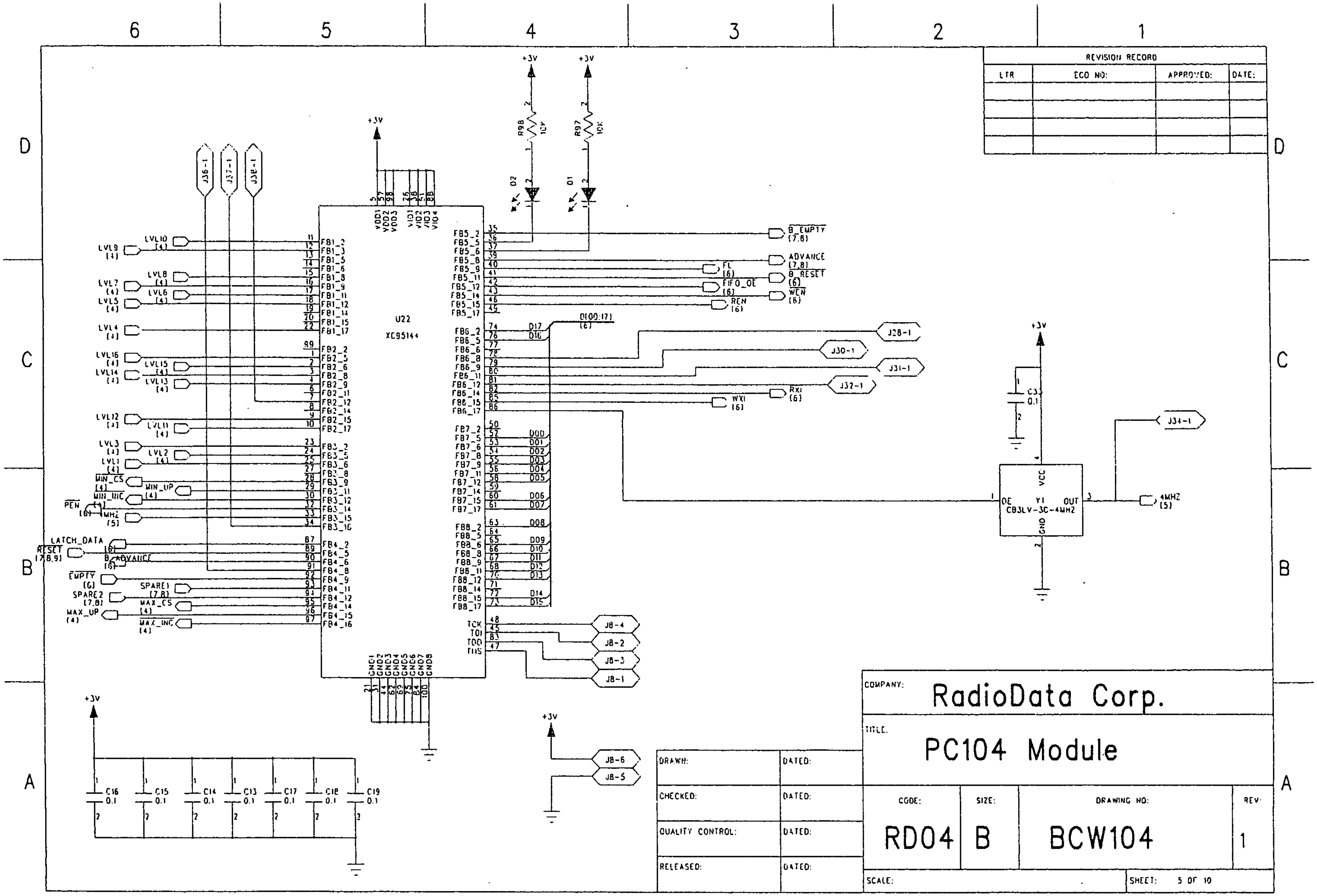

REVISION RECORD
LTR
ECO NO:
APPROVED:
DATE:
U22
XC95144
R98 10K
R97 10K
D2
D1
+3V
J36-1
J37-1
J38-1
J28-1
J30-1
J31-1
J32-1
J34-1
J8-4
J8-2
J8-3
J8-1
J8-6
J8-5
B_EMPTY (7,8)
ADVANCE (7,8)
B_RESET (6)
WEN (6)
FL (6)
FIFO_OE (6)
REN (6)
RXI (6)
WXI (6)
D[00:17] (6)
CB3LV-3C-4MHZ
4MHZ (5)
C33 0.1
C16 0.1
C15 0.1
C14 0.1
C13 0.1
C17 0.1
C18 0.1
C19 0.1
LATCH_DATA
RESET (7,8,9)
B_ADVANCE (6)
EMPTY (6)
SPARE1 (7,8)
SPARE2 (7,8)
MAX_CS (4)
MAX_UP (4)
MAX_INC (4)
MIN_CS (4)
MIN_UP (4)
MIN_INC (4)
PEN (6)
4MHZ (5)
COMPANY: RadioData Corp.
TITLE: PC104 Module
DRAWN: DATED:
CHECKED: DATED:
QUALITY CONTROL: DATED:
RELEASED: DATED:
CODE: RD04
SIZE: B
DRAWING NO: BCW104
REV: 1
SCALE:
SHEET: 5 OF 10

FIG. 2-49

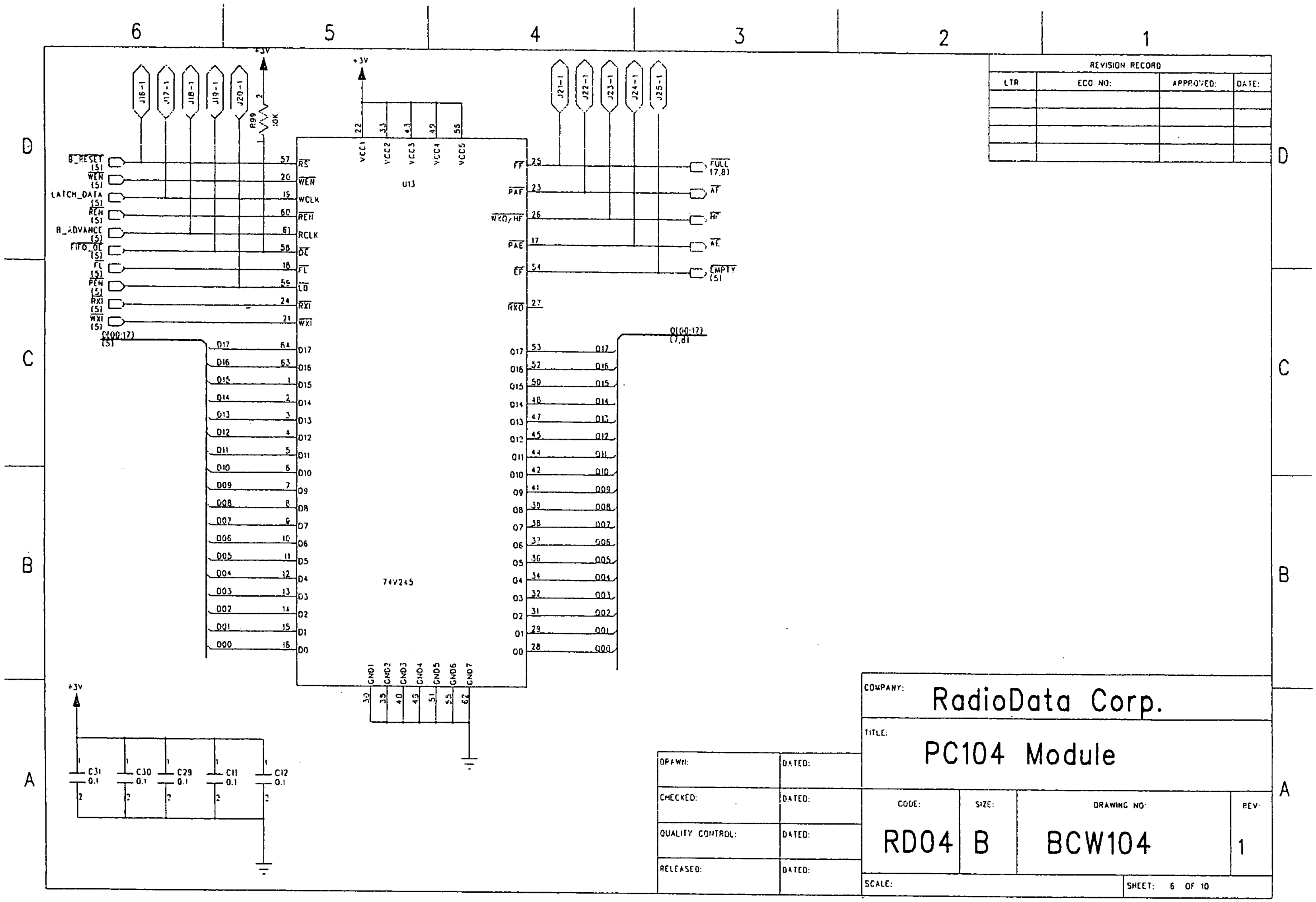
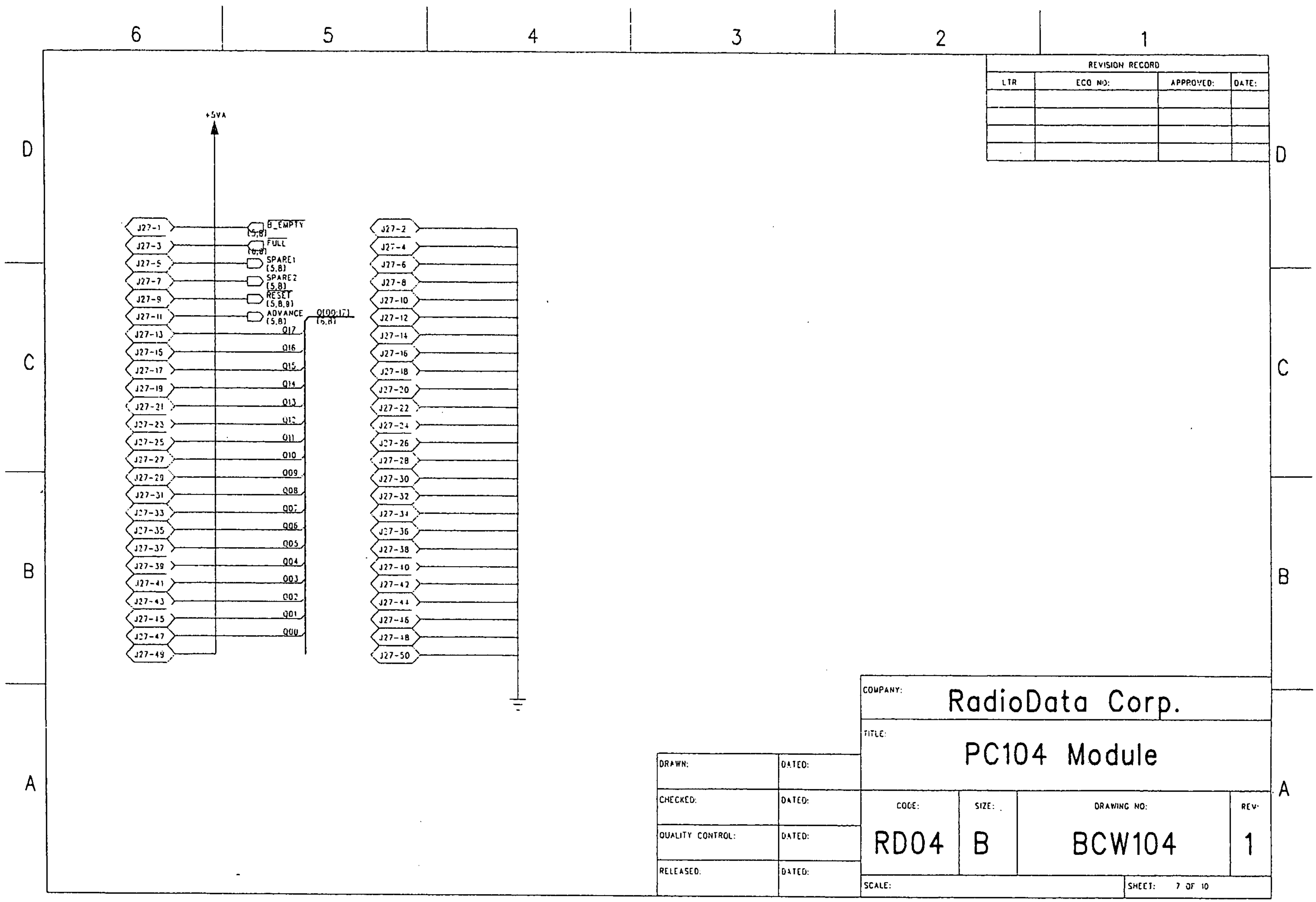

REVISION RECORD
LTR
ECO NO:
APPROVED:
DATE:
U13
74V245
B_RESET
WEN
LATCH_DATA
REN
R_ADVANCE
FIFO_OE
FL
PEN
RXI
WXI
D(00:17)
Q(00:17)
FULL (7,8)
AF
HF
AE
EMPTY (5)
R99
10K
+3V
C31 0.1
C30 0.1
C29 0.1
C11 0.1
C12 0.1
DRAWN:
DATED:
CHECKED:
QUALITY CONTROL:
RELEASED:
COMPANY:
RadioData Corp.
TITLE:
PC104 Module
CODE:
RD04
SIZE:
B
DRAWING NO:
BCW104
REV:
1
SCALE:
SHEET: 6 OF 10

FIG. 2-50



+5VA
J27-1
J27-3
J27-5
J27-7
J27-9
J27-11
J27-13
J27-15
J27-17
J27-19
J27-21
J27-23
J27-25
J27-27
J27-29
J27-31
J27-33
J27-35
J27-37
J27-39
J27-41
J27-43
J27-45
J27-47
J27-49
B_EMPTY (5,8)
FULL (6,8)
SPARE1 (5,8)
SPARE2 (5,8)
RESET (5,8,9)
ADVANCE (5,8)
Q[00:17] (5,8)
Q17
Q16
Q15
Q14
Q13
Q12
Q11
Q10
Q09
Q08
Q07
Q06
Q05
Q04
Q03
Q02
Q01
Q00
J27-2
J27-4
J27-6
J27-8
J27-10
J27-12
J27-14
J27-16
J27-18
J27-20
J27-22
J27-24
J27-26
J27-28
J27-30
J27-32
J27-34
J27-36
J27-38
J27-40
J27-42
J27-44
J27-46
J27-48
J27-50
REVISION RECORD
LTR
ECO NO:
APPROVED:
DATE:
COMPANY: RadioData Corp.
TITLE: PC104 Module
DRAWN:
DATED:
CHECKED:
DATED:
QUALITY CONTROL:
DATED:
RELEASED:
DATED:
CODE: RD04
SIZE: B
DRAWING NO: BCW104
REV: 1
SCALE:
SHEET: 7 OF 10

FIG. 2-51

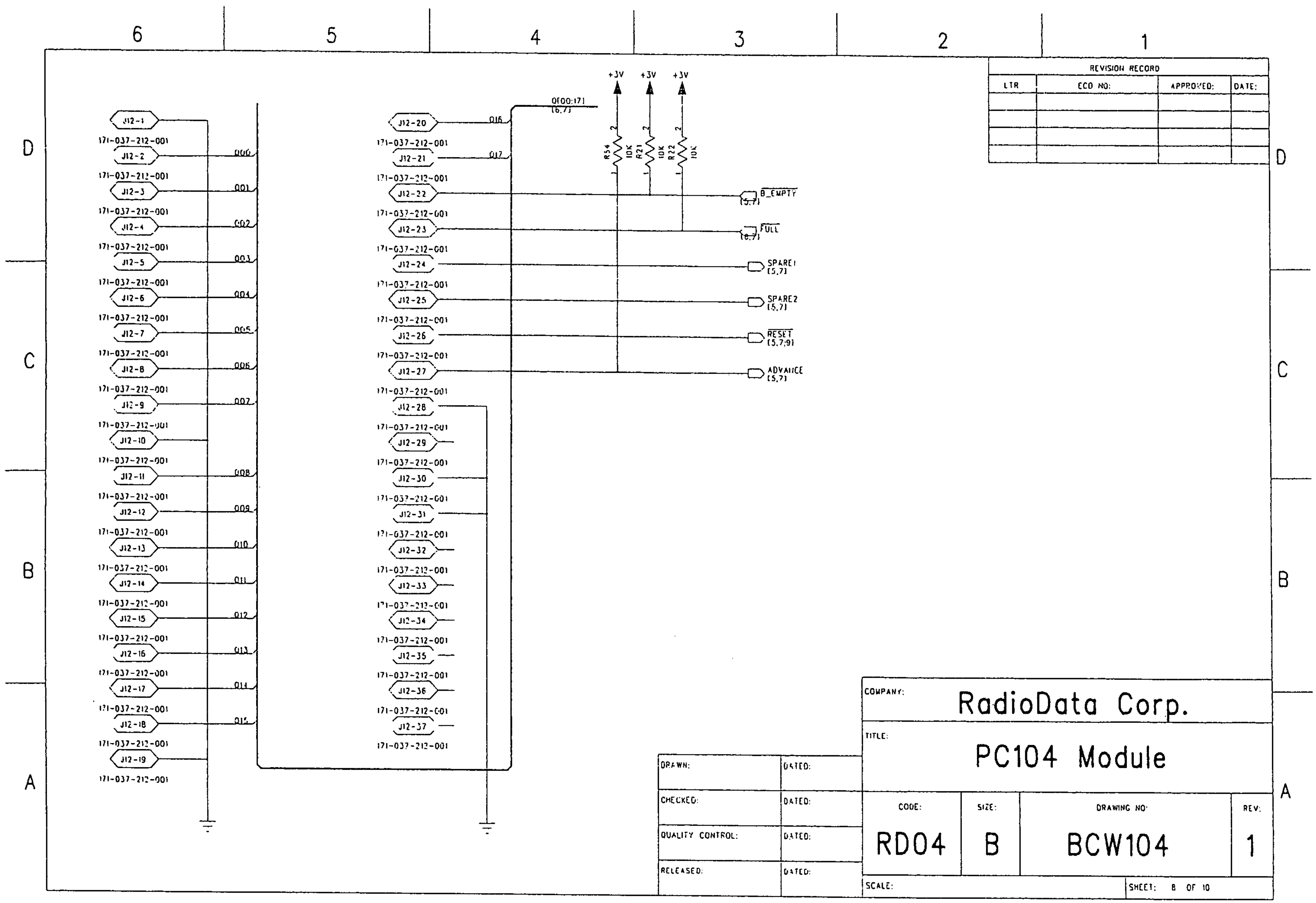
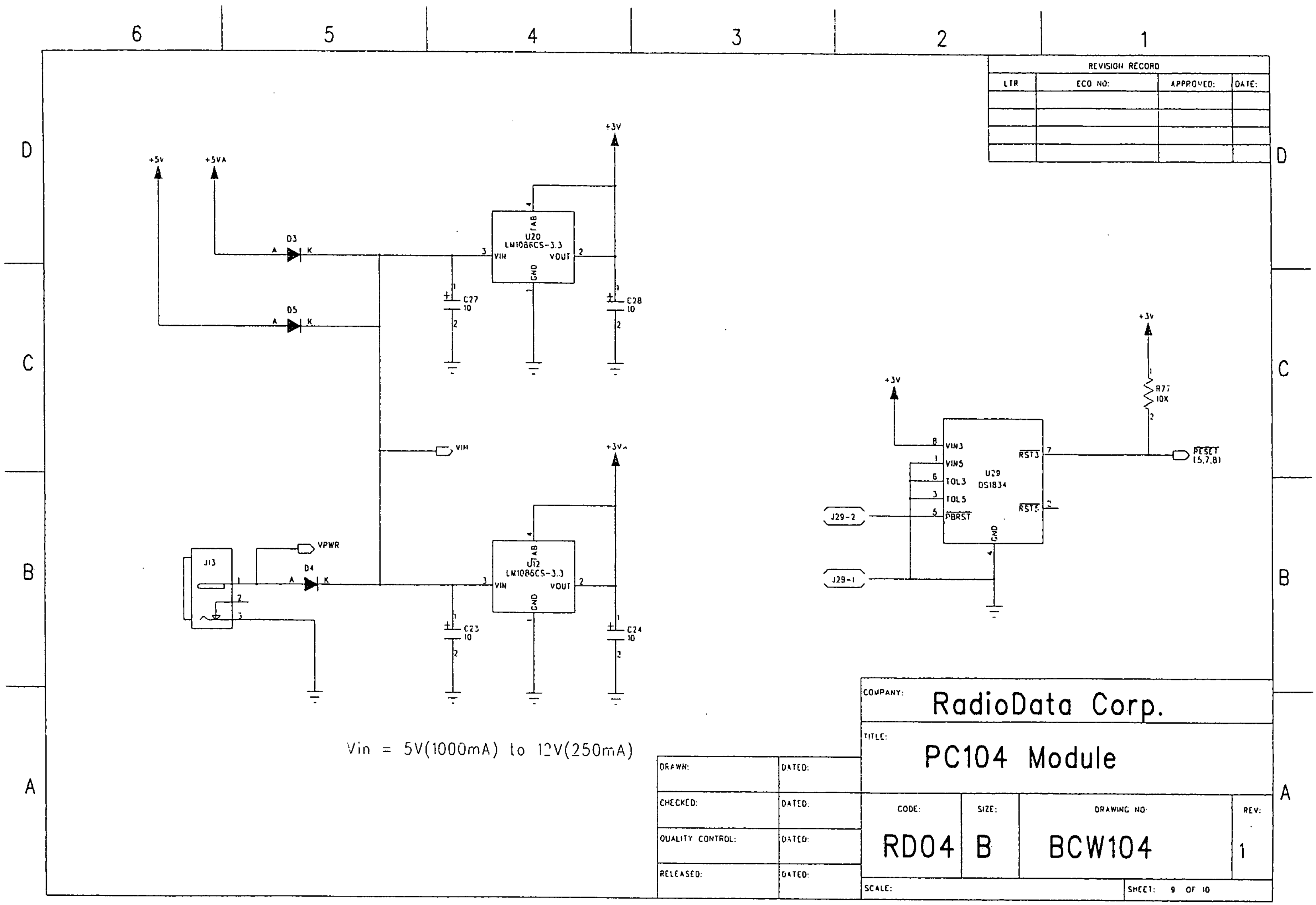

REVISION RECORD
LTR
ECO NO:
APPROVED:
DATE:
J12-1
J12-2
J12-3
J12-4
J12-5
J12-6
J12-7
J12-8
J12-9
J12-10
J12-11
J12-12
J12-13
J12-14
J12-15
J12-16
J12-17
J12-18
J12-19
J12-20
J12-21
J12-22
J12-23
J12-24
J12-25
J12-26
J12-27
J12-28
J12-29
J12-30
J12-31
J12-32
J12-33
J12-34
J12-35
J12-36
J12-37
171-037-212-001
D00
D01
D02
D03
D04
D05
D06
D07
D08
D09
D10
D11
D12
D13
D14
D15
D16
D17
D[00:17]
[6,7]
+3V
R54
R21
R22
10K
B_EMPTY
[5,7]
FULL
[6,7]
SPARE1
[5,7]
SPARE2
[5,7]
RESET
[5,7,9]
ADVANCE
[5,7]
COMPANY:
RadioData Corp.
TITLE:
PC104 Module
CODE:
RD04
SIZE:
B
DRAWING NO:
BCW104
REV:
1
SCALE:
SHEET: 8 OF 10
DRAWN:
CHECKED:
QUALITY CONTROL:
RELEASED:
DATED:

FIG. 2-52



REVISION RECORD
LTR
ECO NO:
APPROVED:
DATE:
+5V
+5VA
D3
D5
D4
A
K
U20
LM1086CS-3.3
VIN
VOUT
GND
ADJ
U12
LM1086CS-3.3
+3V
+3VA
C27
10
C28
10
C23
10
C24
10
VIN
VPWR
J13
U29
DS1834
VIN3
VIN5
TOL3
TOL5
PBRST
RST3
RST5
GND
R77
10K
RESET
(5,7,8)
J29-2
J29-1
Vin = 5V(1000mA) to 12V(250mA)
COMPANY:
RadioData Corp.
TITLE:
PC104 Module
DRAWN:
DATED:
CHECKED:
DATED:
QUALITY CONTROL:
DATED:
RELEASED:
DATED:
CODE:
RD04
SIZE:
B
DRAWING NO:
BCW104
REV:
1
SCALE:
SHEET: 9 OF 10

FIG. 2-53

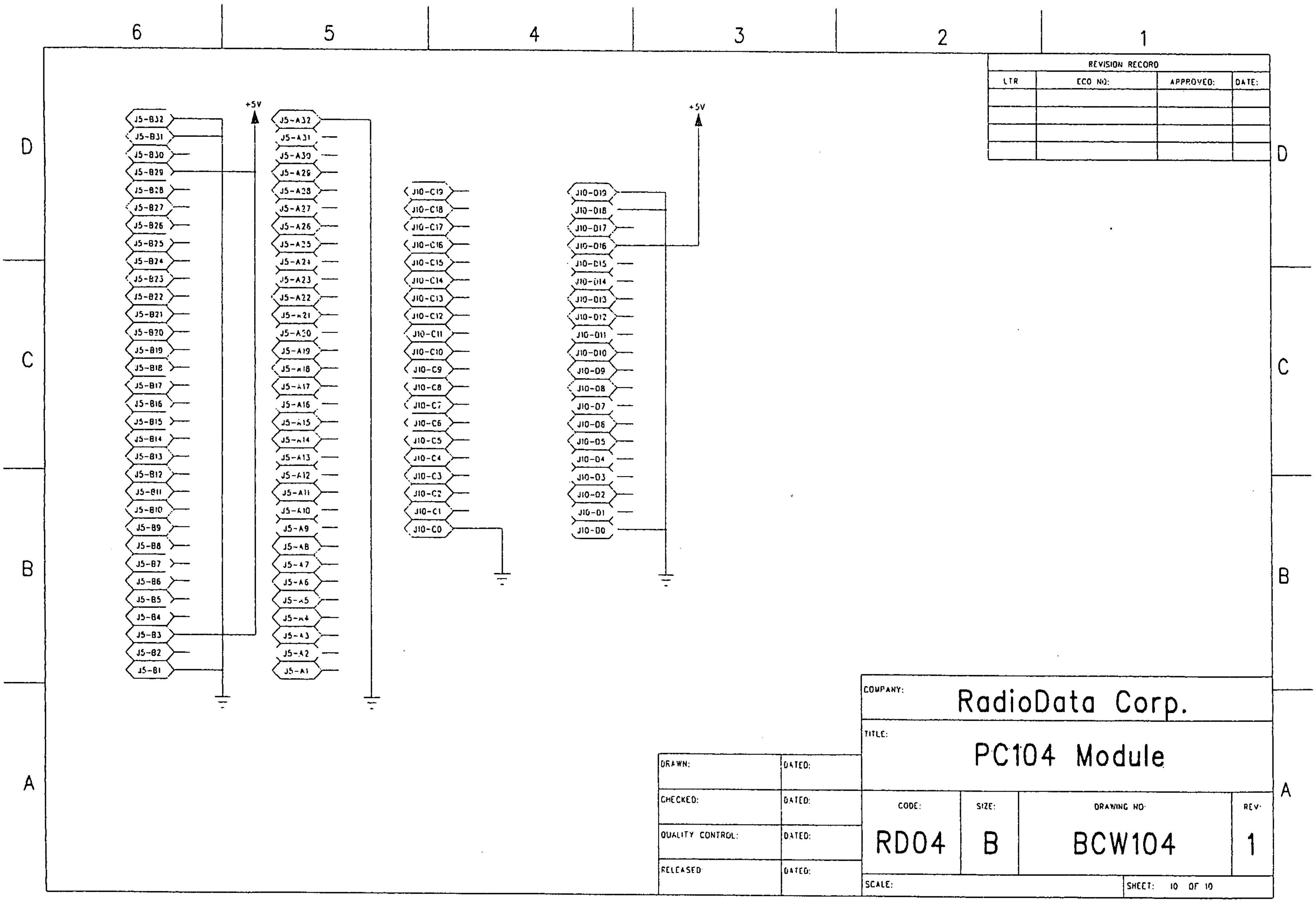
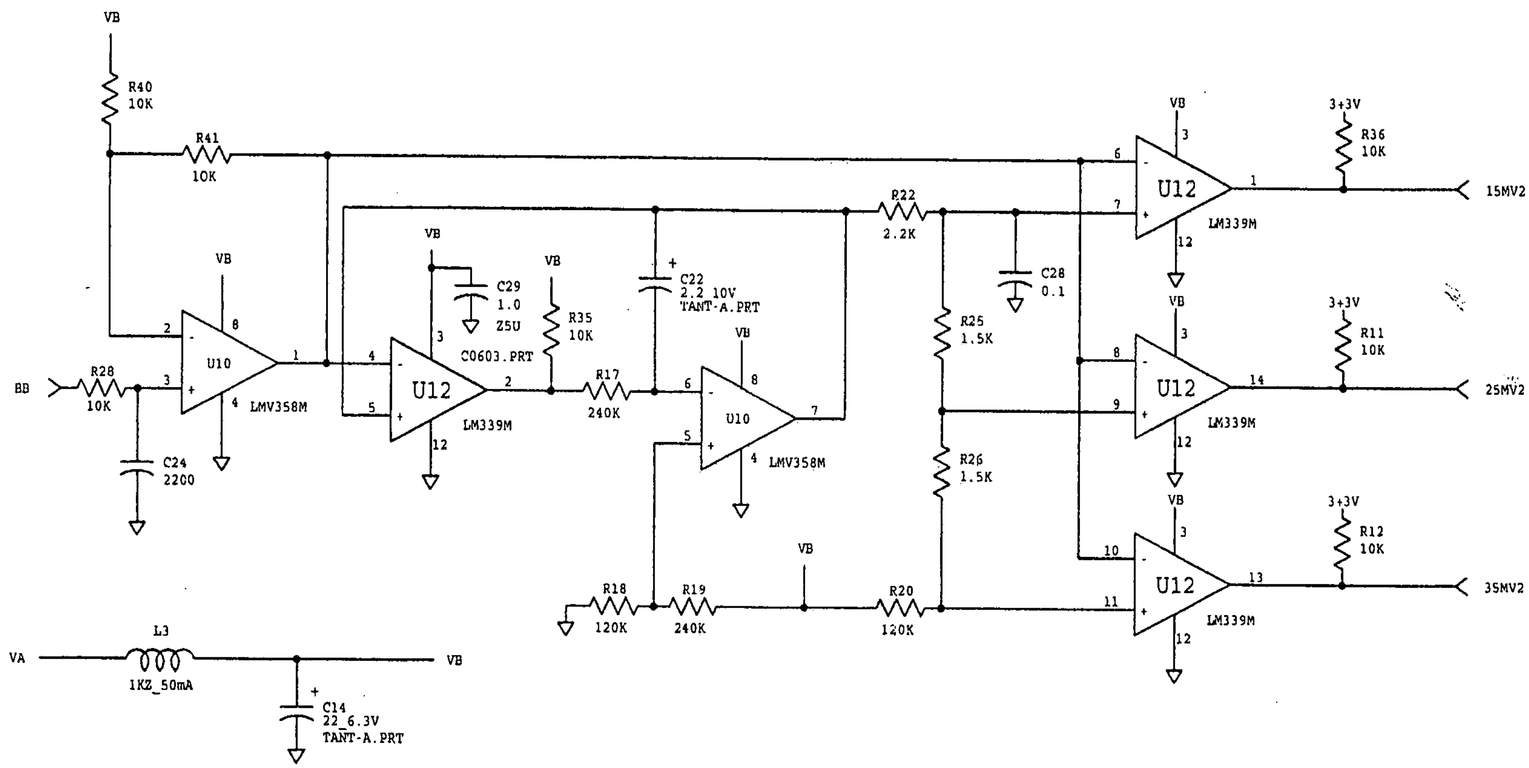

6
5
4
3
2
1
D
C
B
A
REVISION RECORD
LTR
ECO NO:
APPROVED:
DATE:
+5V
+5V
J5-B32
J5-B31
J5-B30
J5-B29
J5-B28
J5-B27
J5-B26
J5-B25
J5-B24
J5-B23
J5-B22
J5-B21
J5-B20
J5-B19
J5-B18
J5-B17
J5-B16
J5-B15
J5-B14
J5-B13
J5-B12
J5-B11
J5-B10
J5-B9
J5-B8
J5-B7
J5-B6
J5-B5
J5-B4
J5-B3
J5-B2
J5-B1
J5-A32
J5-A31
J5-A30
J5-A29
J5-A28
J5-A27
J5-A26
J5-A25
J5-A24
J5-A23
J5-A22
J5-A21
J5-A20
J5-A19
J5-A18
J5-A17
J5-A16
J5-A15
J5-A14
J5-A13
J5-A12
J5-A11
J5-A10
J5-A9
J5-A8
J5-A7
J5-A6
J5-A5
J5-A4
J5-A3
J5-A2
J5-A1
J10-C19
J10-C18
J10-C17
J10-C16
J10-C15
J10-C14
J10-C13
J10-C12
J10-C11
J10-C10
J10-C9
J10-C8
J10-C7
J10-C6
J10-C5
J10-C4
J10-C3
J10-C2
J10-C1
J10-C0
J10-D19
J10-D18
J10-D17
J10-D16
J10-D15
J10-D14
J10-D13
J10-D12
J10-D11
J10-D10
J10-D9
J10-D8
J10-D7
J10-D6
J10-D5
J10-D4
J10-D3
J10-D2
J10-D1
J10-D0
COMPANY:
RadioData Corp.
TITLE:
PC104 Module
DRAWN:
DATED:
CHECKED:
DATED:
QUALITY CONTROL:
DATED:
RELEASED:
DATED:
CODE:
RD04
SIZE:
B
DRAWING NO:
BCW104
REV:
1
SCALE:
SHEET: 10 OF 10

FIG. 2-54

REVISIONS					
ZONE	DFTP	LTR	DESCRIPTION	DATE	APPROVED
		X	INITIAL RELEASE	5/01	
		X	NEW P/N PER ECO 80010051	6/01	



UNLESS OTHERWISE SPECIFIED ALL CAPS AND RESISTORS ARE 0402 PACKAGE

FIG. 2-55

05601570-11 REV X

RF CODE PROPRIETARY STATEMENT

RadioData

10/00

SCH, PCMCIA RC1

C 05601570-11 X

NONE 1 of 8

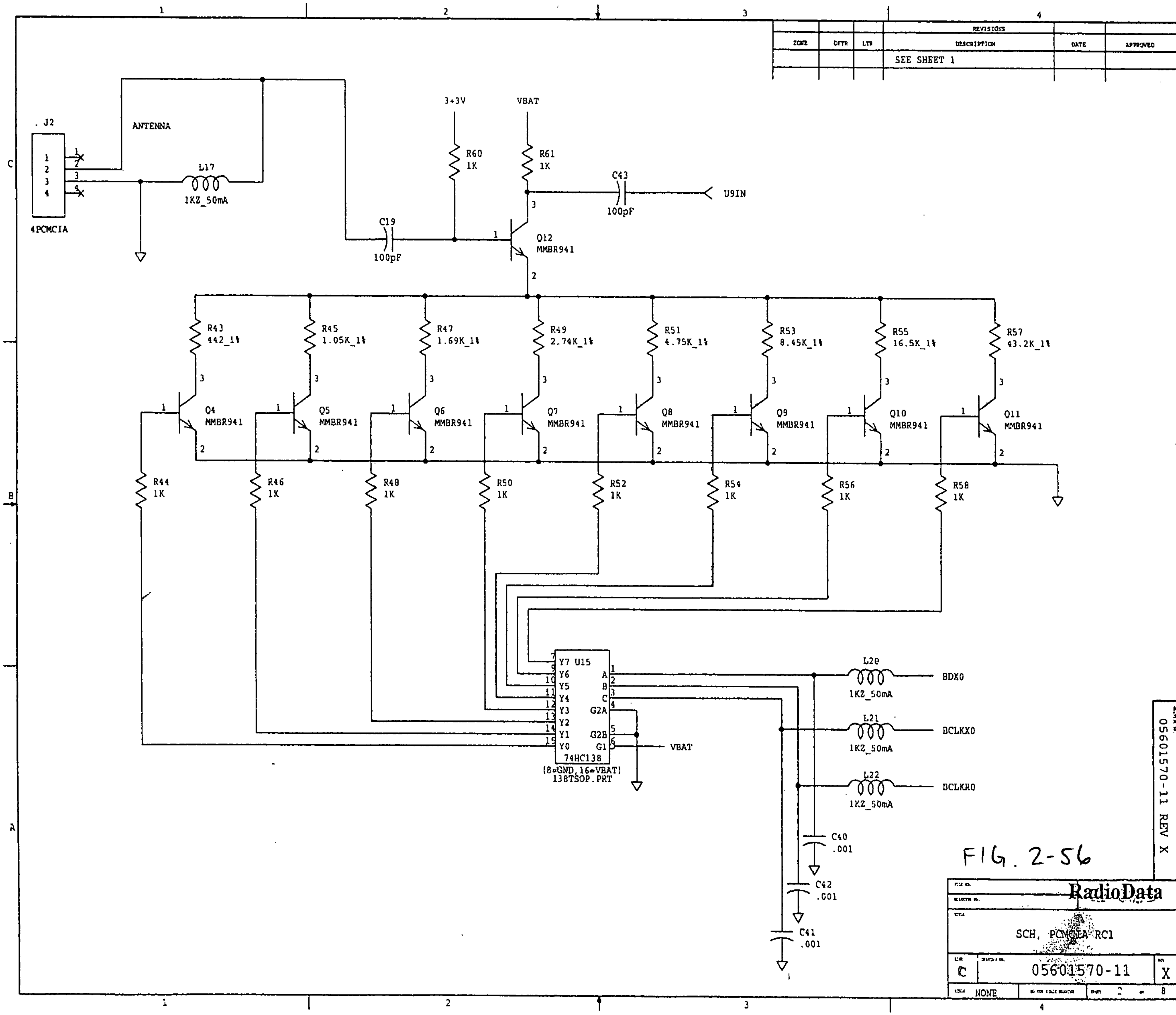
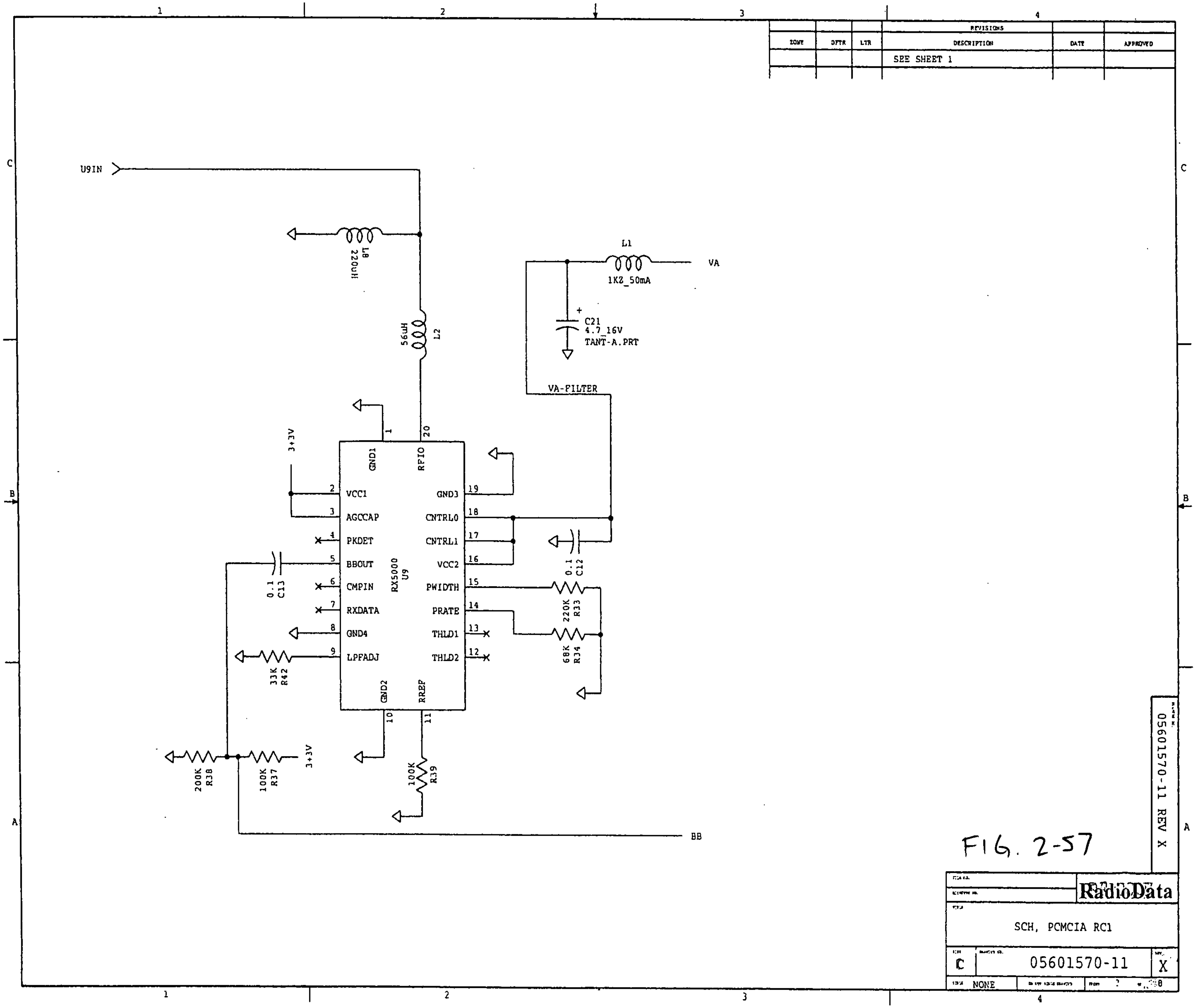
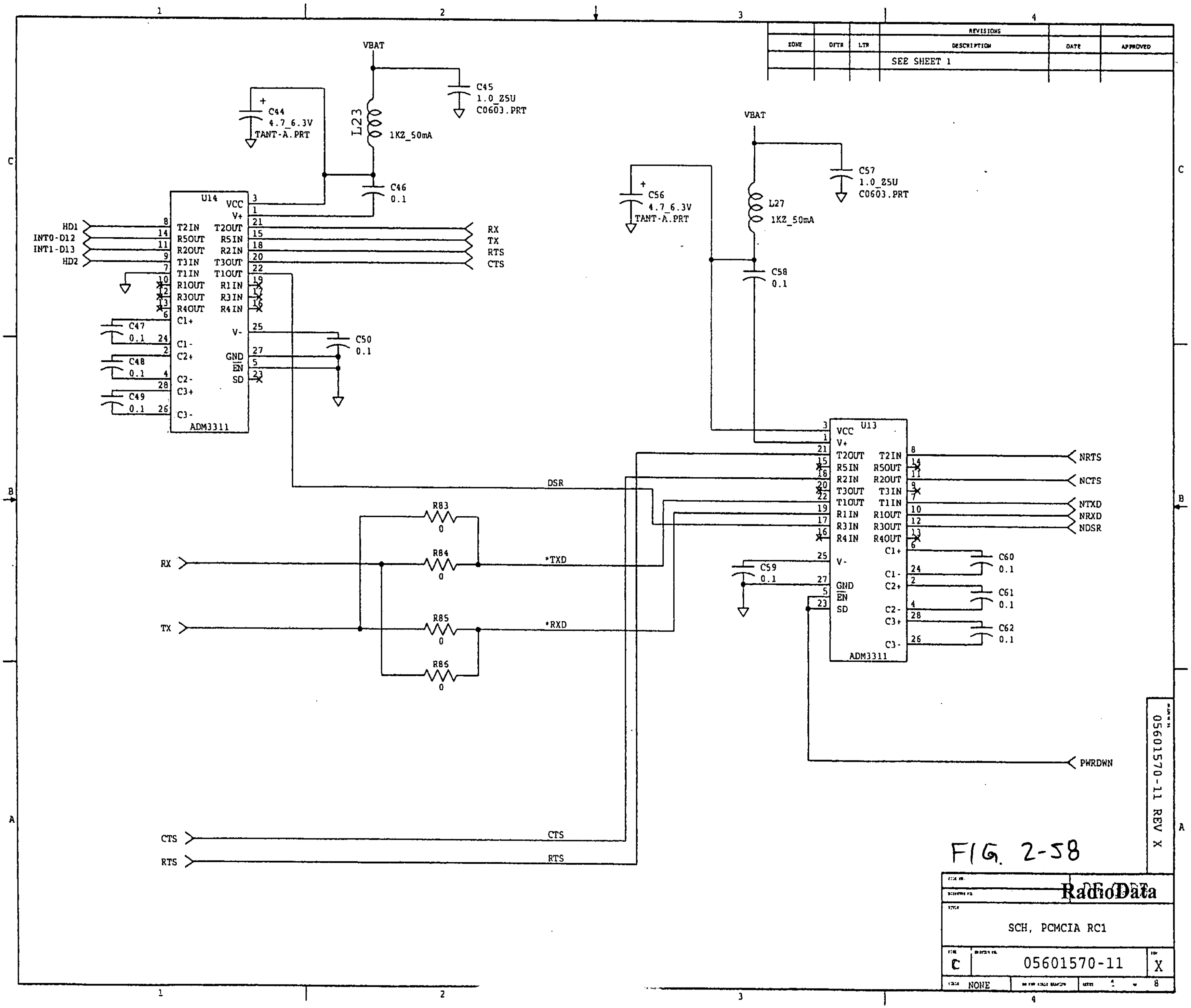

REVISIONS
ZONE
DFTR
LTR
DESCRIPTION
DATE
APPROVED
SEE SHEET 1
J2
4PCMCIA
ANTENNA
L17
1KZ_50mA
3+3V
VBAT
R60
1K
R61
1K
C43
100pF
U9IN
C19
100pF
Q12
MMBR941
R43
442_1%
R45
1.05K_1%
R47
1.69K_1%
R49
2.74K_1%
R51
4.75K_1%
R53
8.45K_1%
R55
16.5K_1%
R57
43.2K_1%
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
MMBR941
R44
R46
R48
R50
R52
R54
R56
R58
1K
U15
74HC138
(8=GND,16=VBAT)
138TSOP.PRT
L20
L21
L22
1KZ_50mA
BDX0
DCLKX0
DCLKR0
C40
.001
C42
.001
C41
.001
05601570-11 REV X
RadioData
SCH, PCMCIA RC1
C
05601570-11
X
NONE

FIG. 2-56



REVISIONS
ZONE
DFTR
LTR
DESCRIPTION
DATE
APPROVED
SEE SHEET 1
U9IN
L8
220uH
L2
56uH
L1
1K2_50mA
VA
C21
4.7_16V
TANT-A.PRT
VA-FILTER
3+3V
GND1
RFIO
VCC1
AGCCAP
PKDET
BBOUT
CMPIN
RXDATA
GND4
LPFADJ
GND3
CNTRL0
CNTRL1
VCC2
PWIDTH
PRATE
THLD1
THLD2
GND2
RREF
RX5000
U9
0.1
C13
0.1
C12
220K
R33
68K
R34
33K
R42
200K
R38
100K
R37
100K
R39
BB
05601570-11 REV X
RadioData
SCH, PCMCIA RC1
C
05601570-11
X
NONE

FIG. 2-57



REVISIONS
ZONE
DFTR
LTR
DESCRIPTION
DATE
APPROVED
SEE SHEET 1
VBAT
C44
4.7_6.3V
TANT-A.PRT
L23
1KZ_50mA
C45
1.0_Z5U
C0603.PRT
C46
0.1
U14
ADM3311
VCC
V+
T2IN
R5OUT
R2OUT
T3IN
T1IN
R1OUT
R3OUT
R4OUT
C1+
C1-
C2+
C2-
C3+
C3-
T2OUT
R5IN
R2IN
T3OUT
T1OUT
R1IN
R3IN
R4IN
V-
GND
EN
SD
HD1
INT0-D12
INT1-D13
HD2
RX
TX
RTS
CTS
C47
0.1
C48
0.1
C49
0.1
C50
0.1
DSR
R83
0
R84
0
R85
0
R86
0
*TXD
*RXD
VBAT
C56
4.7_6.3V
TANT-A.PRT
L27
1KZ_50mA
C57
1.0_Z5U
C0603.PRT
C58
0.1
U13
ADM3311
C59
0.1
C60
0.1
C61
0.1
C62
0.1
NRTS
NCTS
NTXD
NRXD
NDSR
PWRDWN
05601570-11 REV X
RadioData
SCH, PCMCIA RC1
C
05601570-11
X
NONE

FIG. 2-58

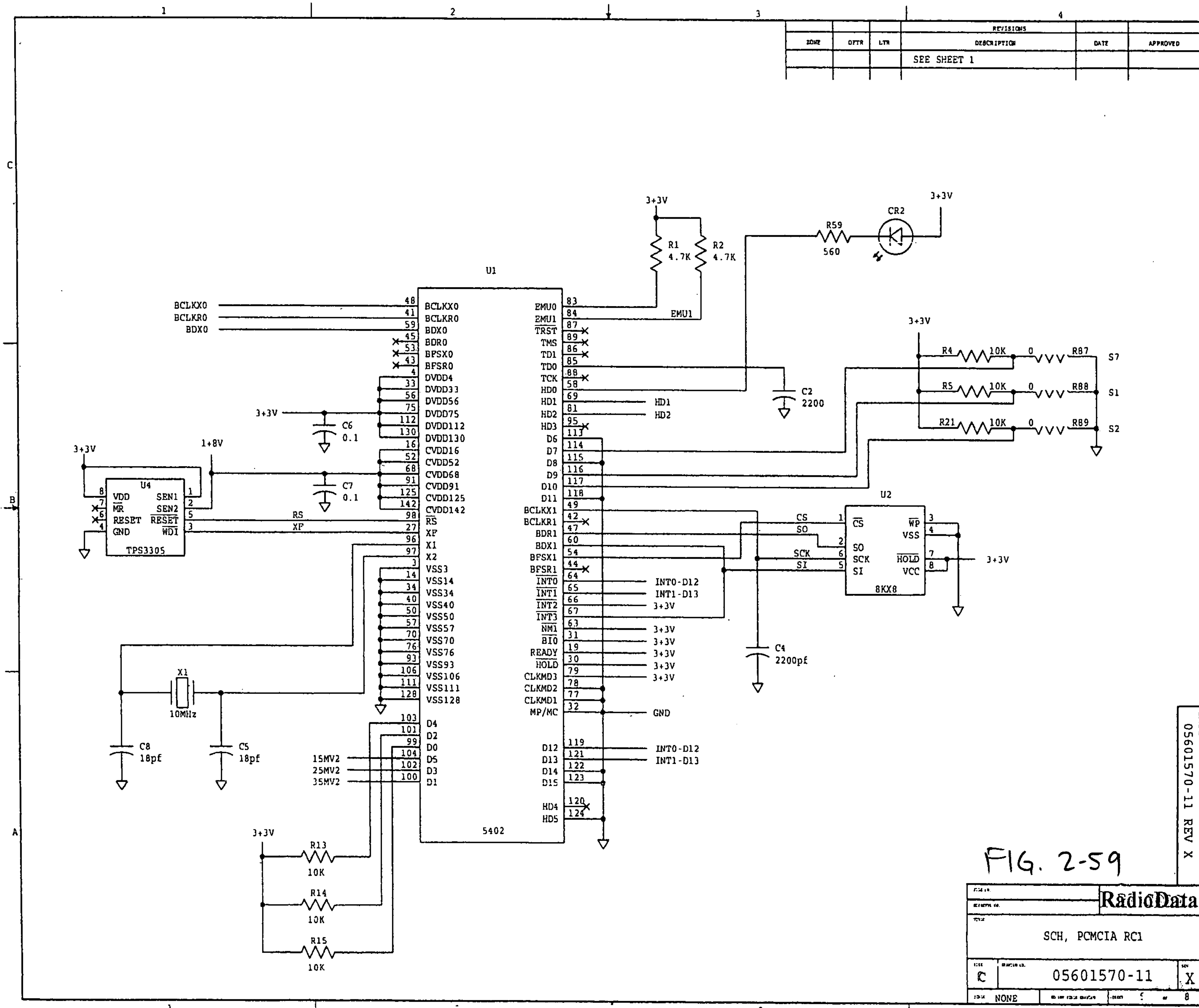


FIG. 2-59

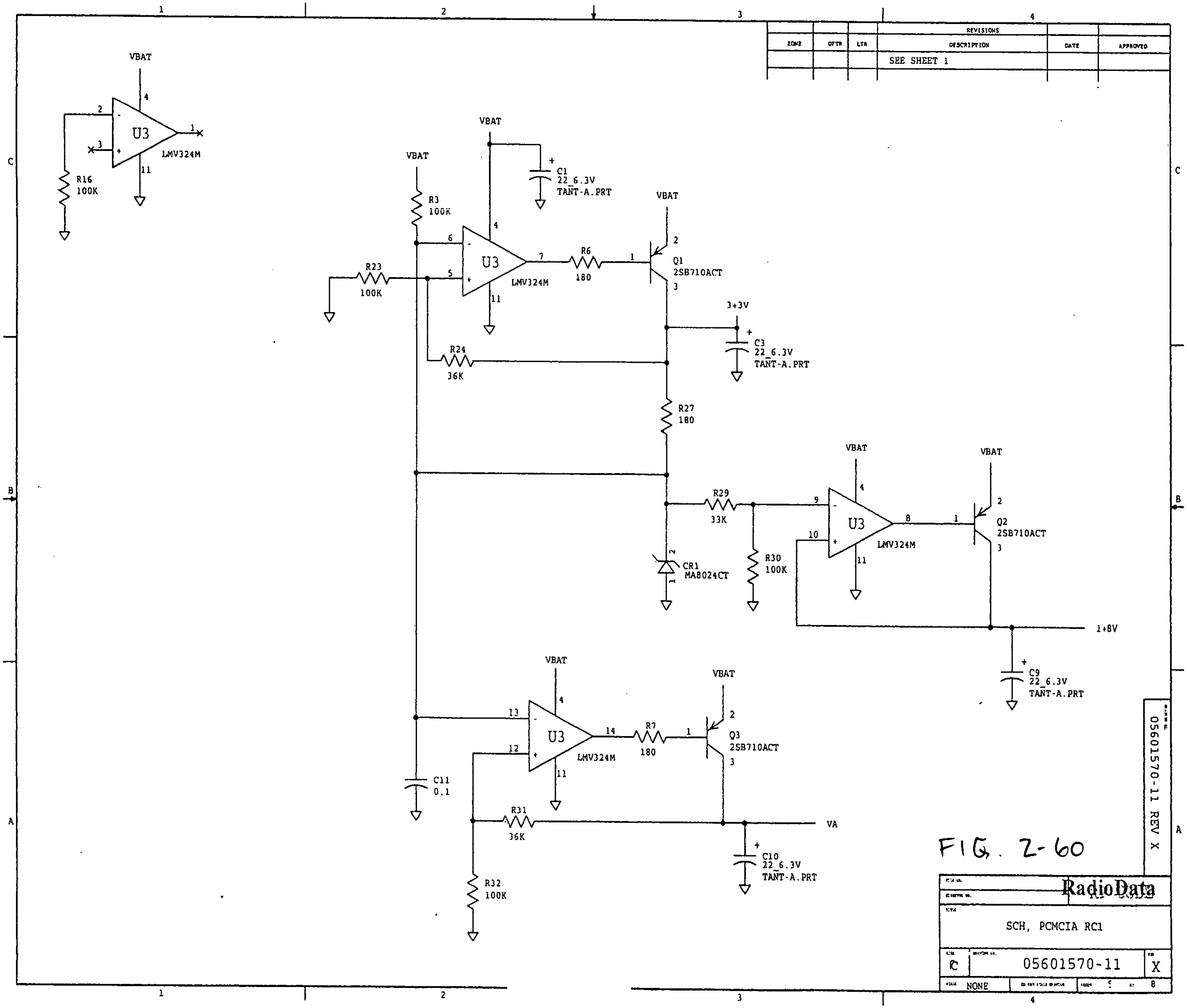
05601570-11 REV X

RadioData

SCH, PCMCIA RC1

C 05601570-11 X

NONE 8



REVISIONS
ZONE
DFTR
LTR
DESCRIPTION
DATE
APPROVED
SEE SHEET 1
VBAT
U3
LMV324M
R16
100K
C1
22_6.3V
TANT-A.PRT
R3
100K
R23
100K
R6
180
Q1
2SB710ACT
3+3V
C3
22_6.3V
TANT-A.PRT
R24
36K
R27
180
R29
33K
CR1
MA8024CT
R30
100K
Q2
2SB710ACT
1+8V
C9
22_6.3V
TANT-A.PRT
C11
0.1
R7
180
Q3
2SB710ACT
R31
36K
VA
C10
22_6.3V
TANT-A.PRT
R32
100K
05601570-11 REV X
RadioData
SCH, PCMCIA RC1
C
05601570-11
X
NONE

FIG. 2-60

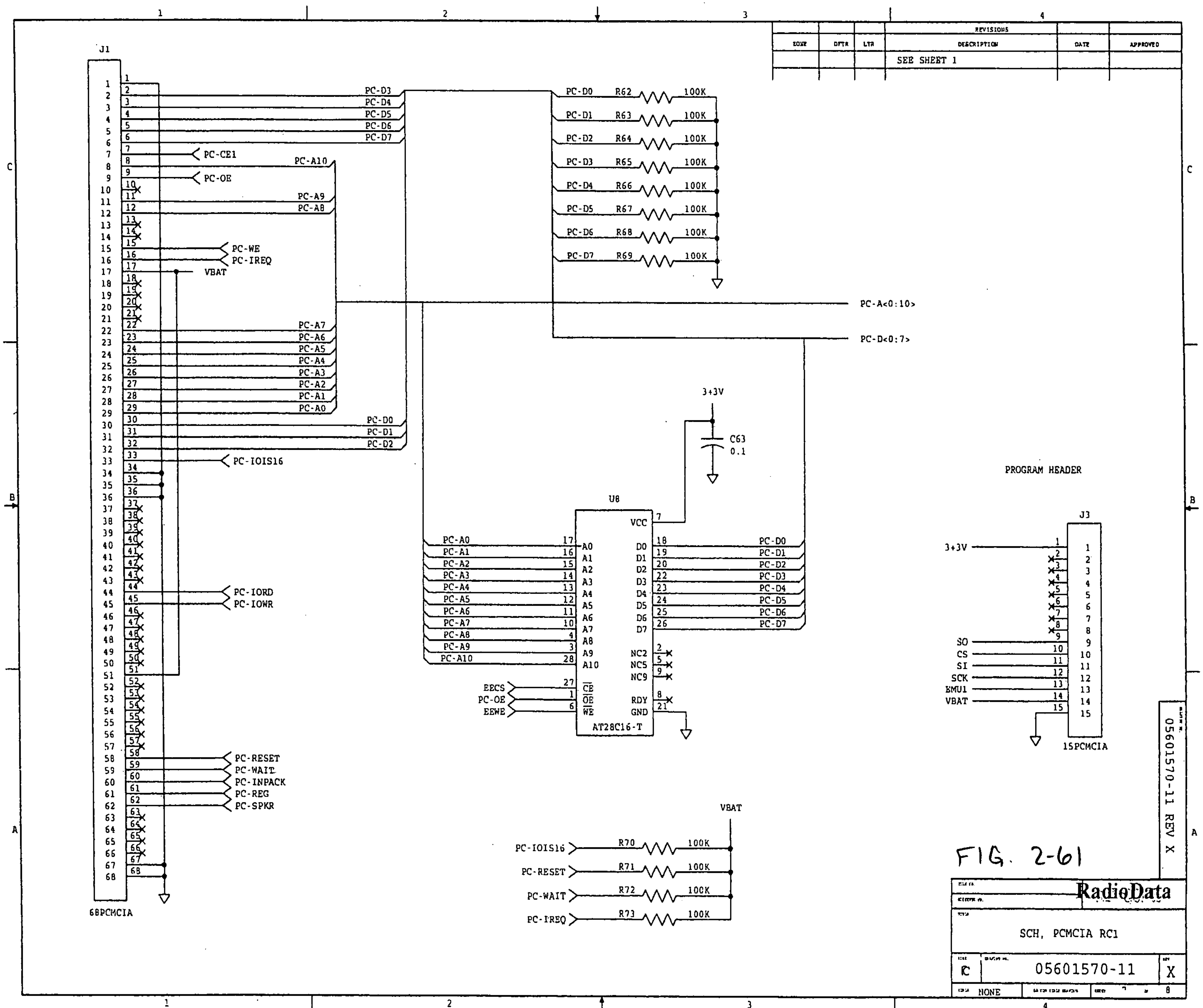

J1
68PCMCIA
PC-D3
PC-D4
PC-D5
PC-D6
PC-D7
PC-CE1
PC-OE
PC-A10
PC-A9
PC-A8
PC-WE
PC-IREQ
VBAT
PC-A7
PC-A6
PC-A5
PC-A4
PC-A3
PC-A2
PC-A1
PC-A0
PC-D0
PC-D1
PC-D2
PC-IOIS16
PC-IORD
PC-IOWR
PC-RESET
PC-WAIT
PC-INPACK
PC-REG
PC-SPKR
R62 100K
R63 100K
R64 100K
R65 100K
R66 100K
R67 100K
R68 100K
R69 100K
PC-A<0:10>
PC-D<0:7>
3+3V
C63
0.1
U8
AT28C16-T
VCC
NC2
NC5
NC9
RDY
GND
EECS
EEWE
PROGRAM HEADER
J3
15PCMCIA
SO
CS
SI
SCK
EMU1
R70 100K
R71 100K
R72 100K
R73 100K
REVISIONS
ZONE
DFTR
LTR
DESCRIPTION
DATE
APPROVED
SEE SHEET 1
05601570-11 REV X
RadioData
SCH, PCMCIA RC1
C
05601570-11
X
NONE

FIG. 2-61

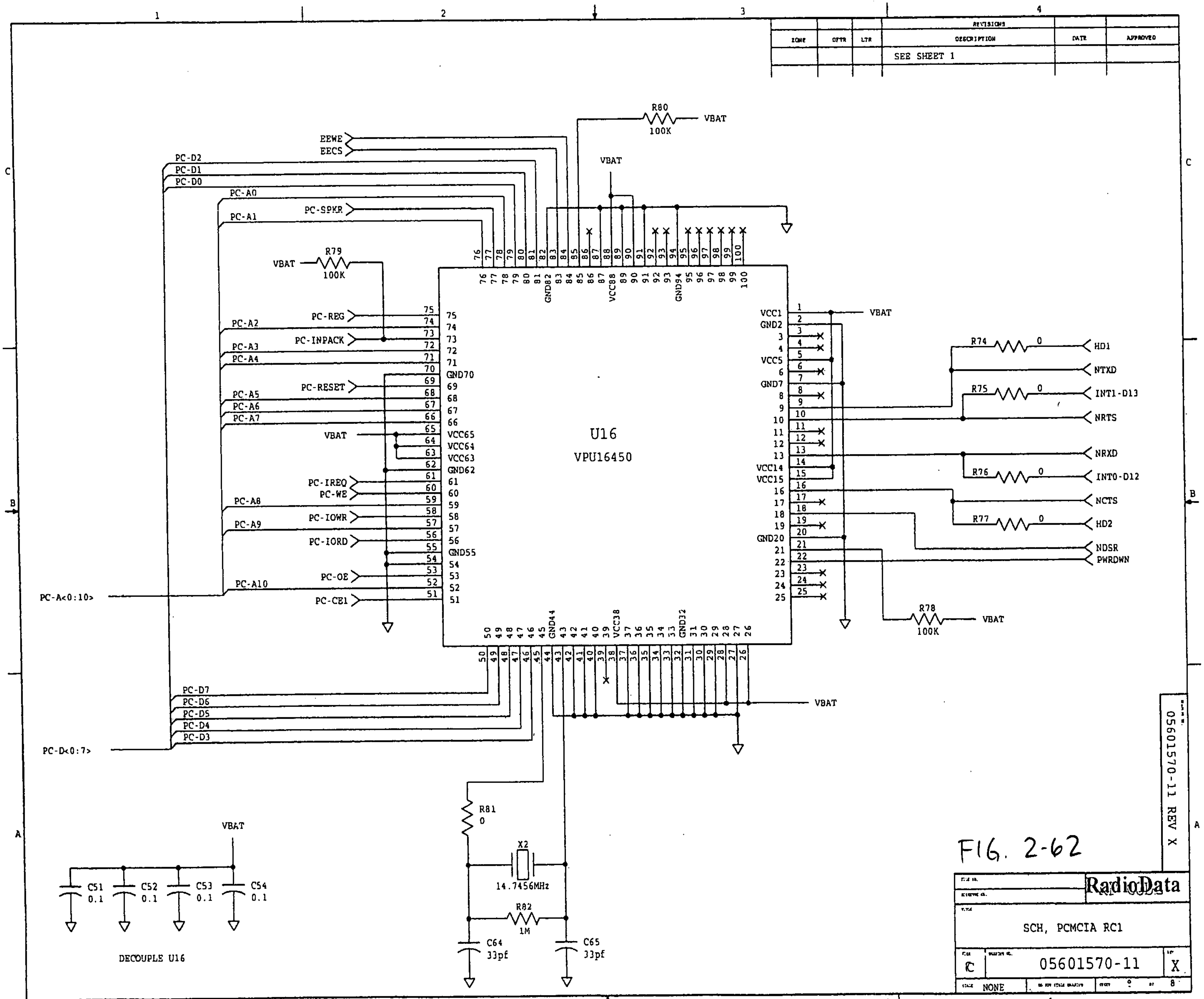
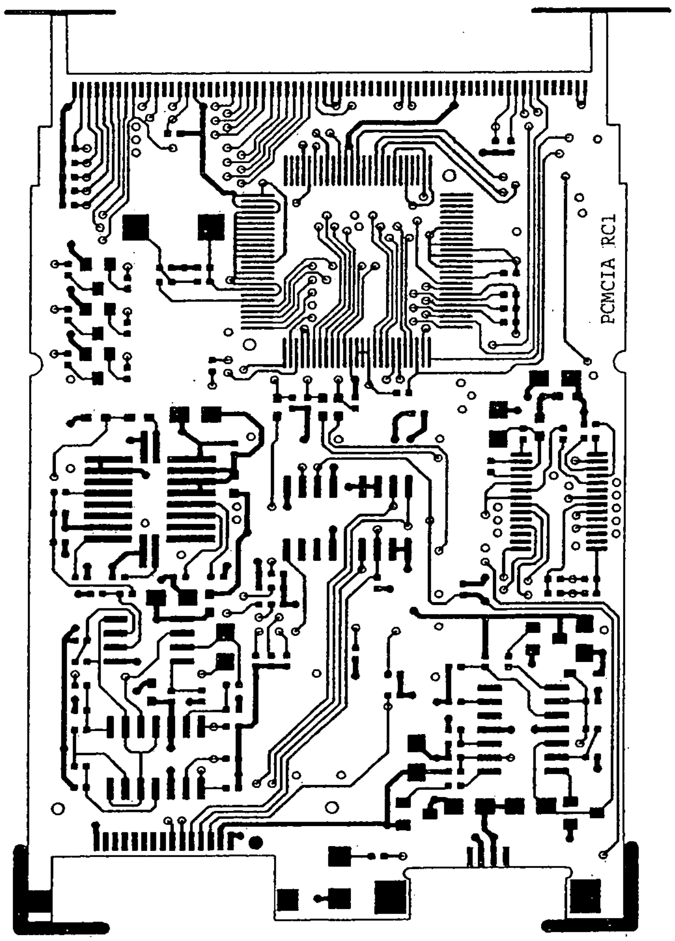

REVISIONS
ZONE
OFTR
LTR
DESCRIPTION
DATE
APPROVED
SEE SHEET 1
U16
VPU16450
VBAT
R74 0
R75 0
R76 0
R77 0
R78 100K
R79 100K
R80 100K
R81 0
R82 1M
X2 14.7456MHz
C64 33pf
C65 33pf
C51 0.1
C52 0.1
C53 0.1
C54 0.1
DECOUPLE U16
HD1
NTXD
INT1-D13
NRTS
NRXD
INT0-D12
NCTS
HD2
NDSR
PWRDWN
EEWE
EECS
PC-SPKR
PC-REG
PC-INPACK
PC-RESET
PC-IREQ
PC-WE
PC-IOWR
PC-IORD
PC-OE
PC-CE1
PC-A<0:10>
PC-D<0:7>
VCC1
GND2
VCC5
GND7
VCC14
VCC15
GND20
VCC38
GND32
GND44
GND55
GND62
VCC63
VCC64
VCC65
GND70
GND82
VCC88
GND94
RadioData
SCH, PCMCIA RC1
C
05601570-11
X
NONE
05601570-11 REV X

FIG. 2-62

APPROVED ____________ DATE ____________



LAYER 1

TOP CIRCUIT

RadioData Corporation

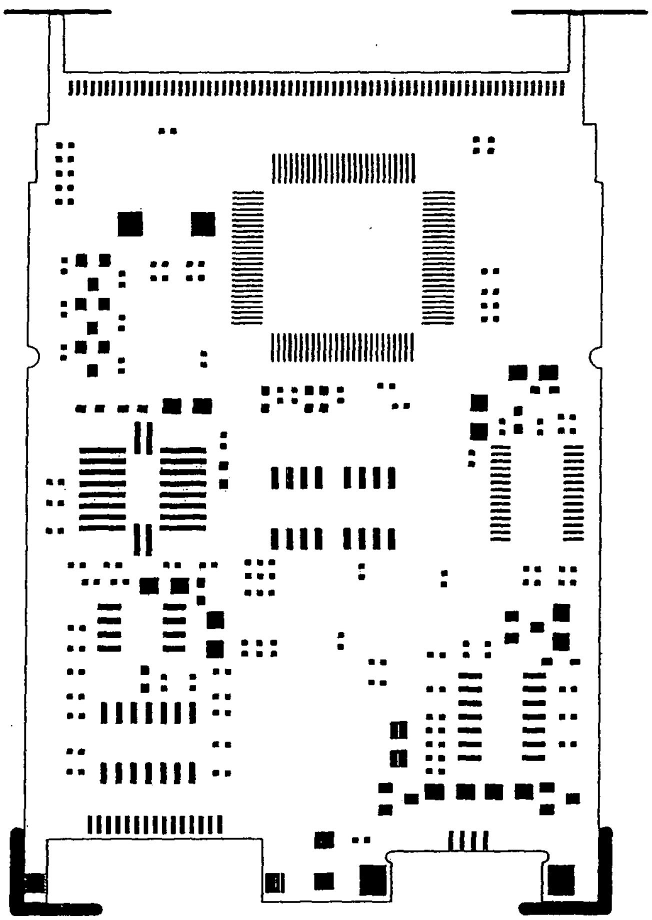
AW, PCMCIA RC1

05901570-11 REV X

SHEET 1 OF 10

FIG 2-63

APPROVED ____________ DATE ____________



RF CODE

TOP SOLDERPASTE

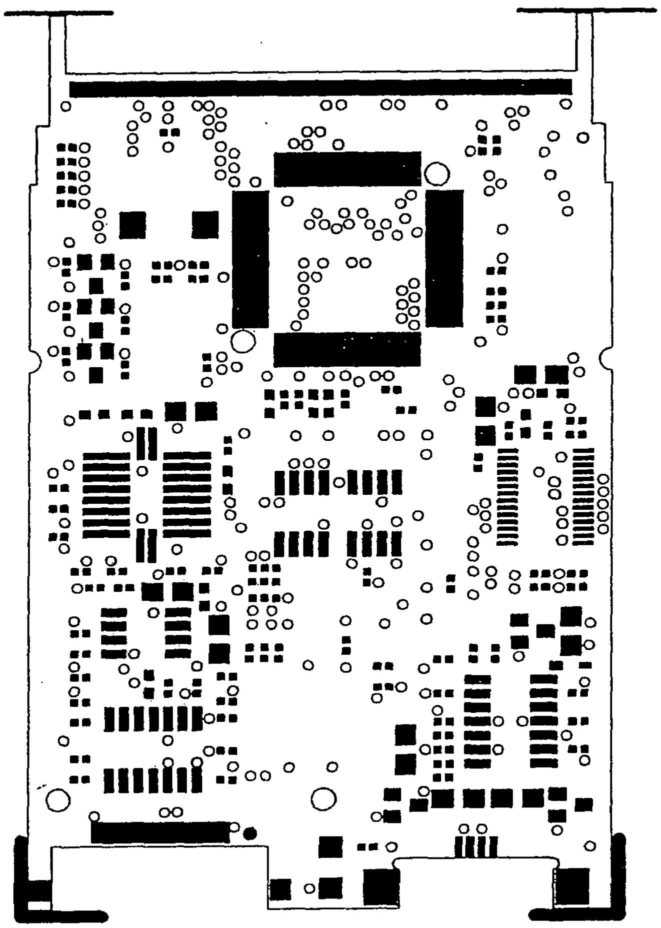
AW, PCMCIA RC1

05901570-11 REV X

SHEET 2 OF 10

FIG 2-64

APPROVED ____________ DATE ____________



RadioData Corporation

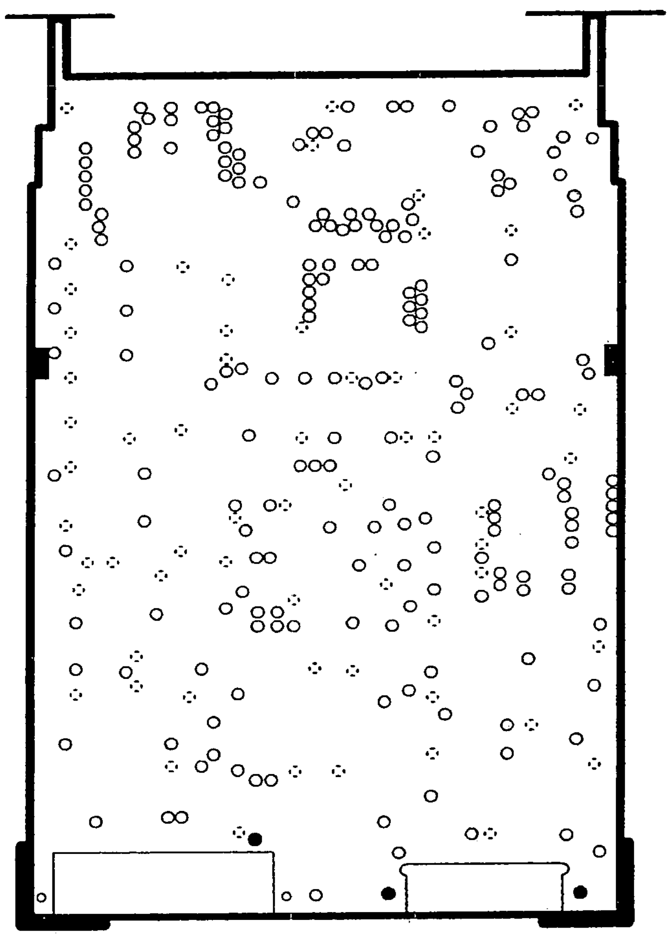
AW, PCMCIA RC1

05901570-11 REV X

TOP SOLDERMASK SHEET 3 OF 10

FIG. 2-65

APPROVED ____________ DATE ____________



LAYER 2

GROUND PLANE

RadioData Corporation

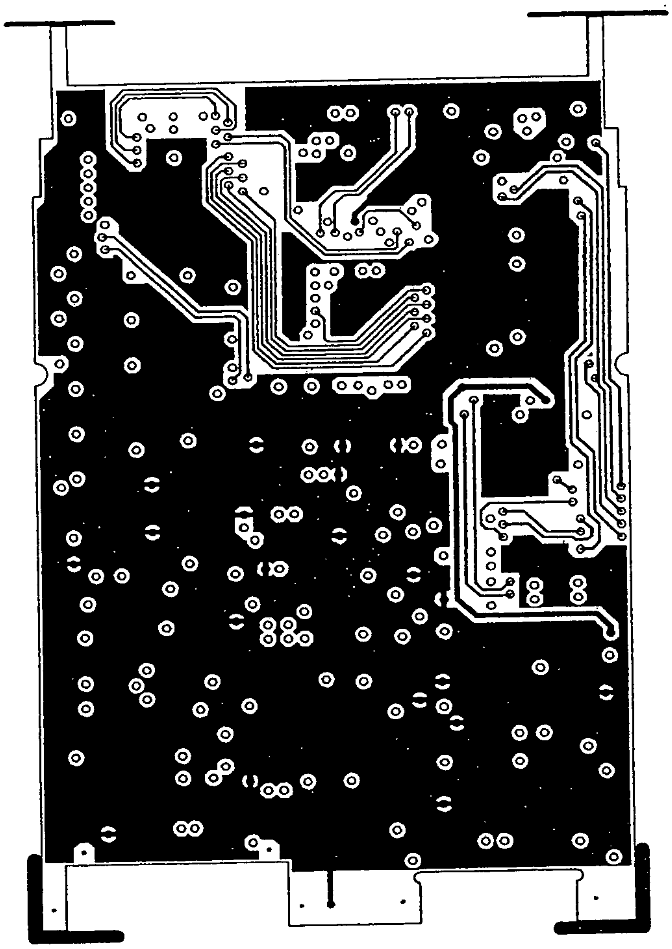
AW, PCMCIA RC1

05901570-11 REV X

SHEET 4 OF 10

FIG. 2-66

APPROVED ____________ DATE ____________

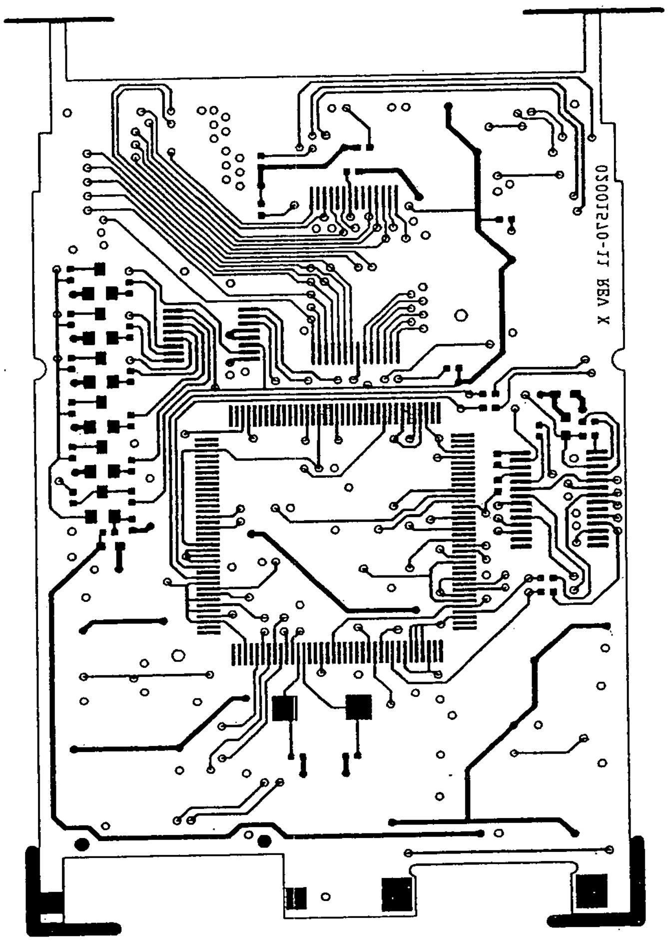


LAYER 3

RadioData Corporation
AW, PCMCIA RC1
05901570-11 REV X
SHEET 5 OF 10

FIG. 2-67

APPROVED ______________ DATE ______________



LAYER 4

RadioData Corporation

AW, PCMCIA RC1

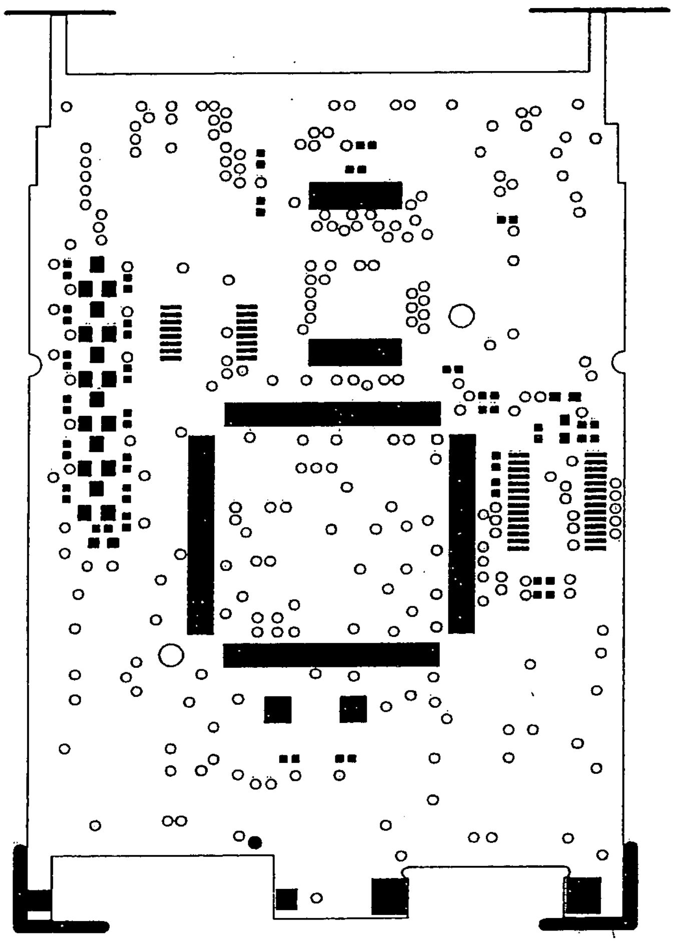
05901570-11 REV X

BOTTOM CIRCUIT

SHEET 6 OF 10

FIG. 2-68

APPROVED ____________ DATE ____________



RadioData Corporation

AW, PCMCIA RC1

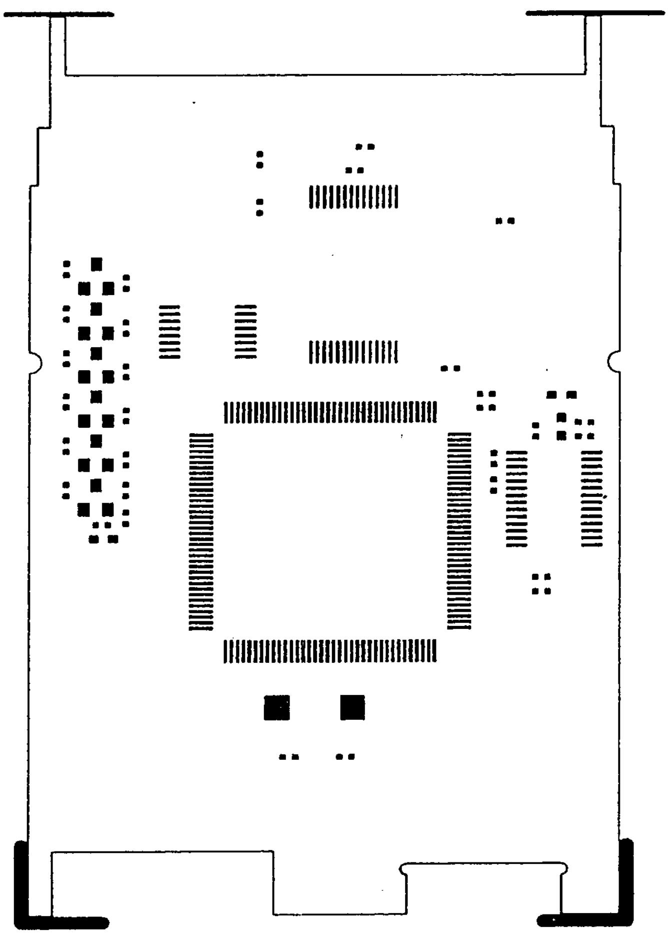
05901570-11 REV X

SHEET 7 OF 10

BOTTOM SOLDERMASK

FIG. 2-69

APPROVED ____________ DATE ____________



RadioData Corporation

AW, PCMCIA RC1

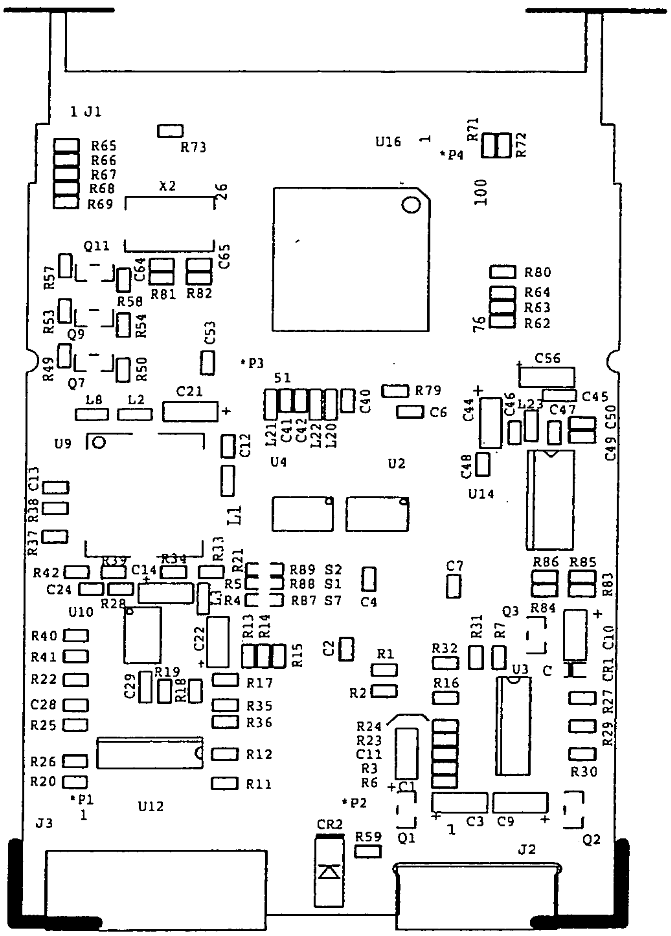
05901570-11 REV X

BOTTOM SOLDERPASTE

SHEET 8 OF 10

FIG 2-70

APPROVED ____________ DATE ____________



RadioData Corporation

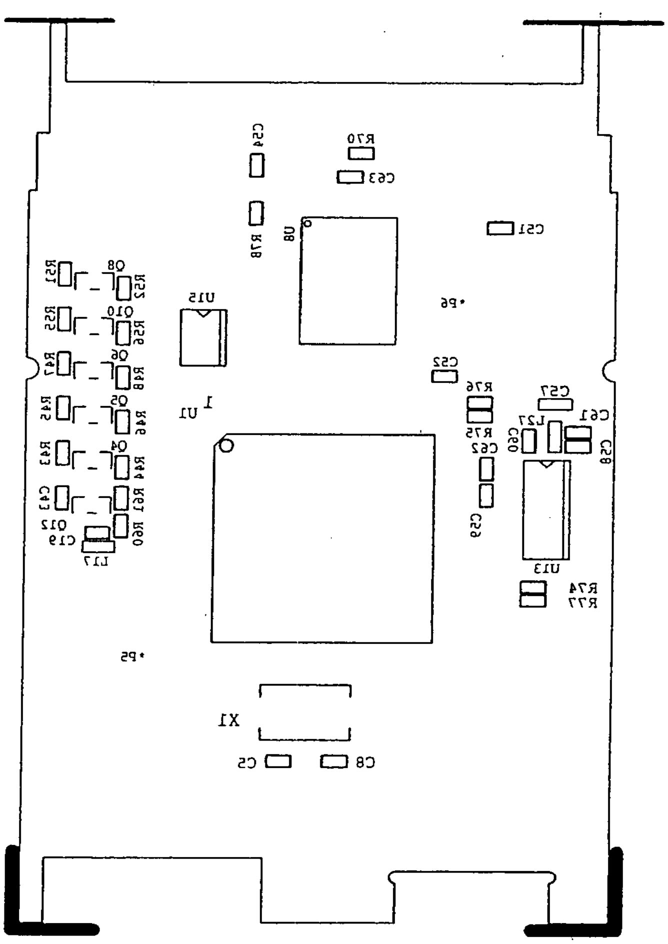
AW, PCMCIA RC1

05901570-11 REV X

SHEET 9 OF 10

FIG 2-71

APPROVED ____________ DATE ____________



RadioData Corporation

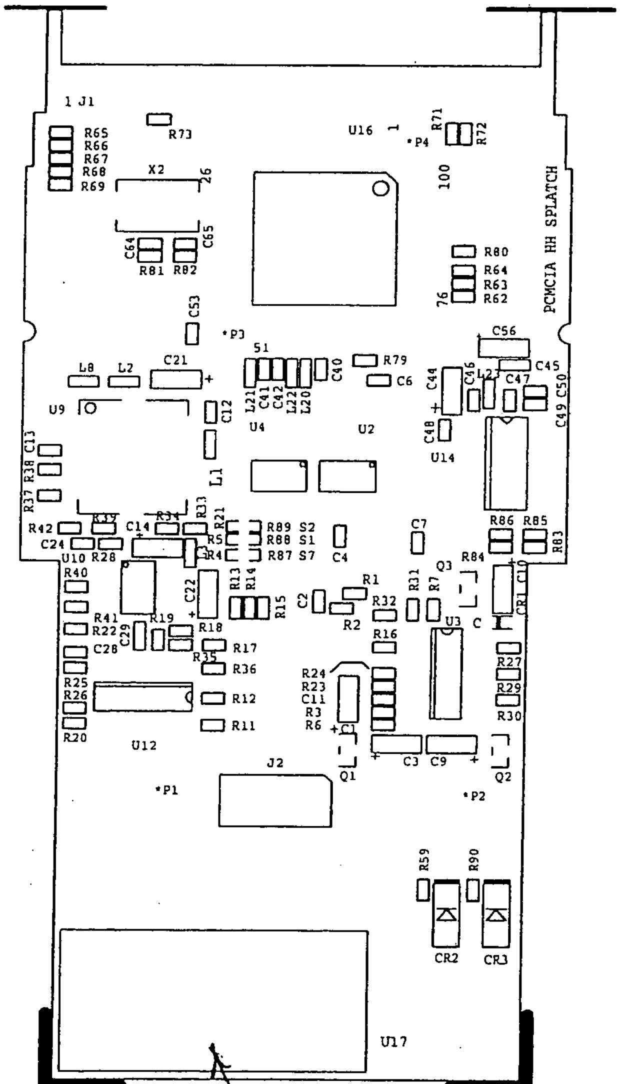
AW, PCMCIA RC1

05901570-11 REV X

SHEET 106 OF 10

FIG 2-72

APPROVED ____________ DATE ____________



Splatch Antenna

RadioData Corporation

AW, PCMCIA HH SPLATCH

05901633-11 REV X

TOP SILKSCREEN

SHEET 9 OF 10

FIG 2-73

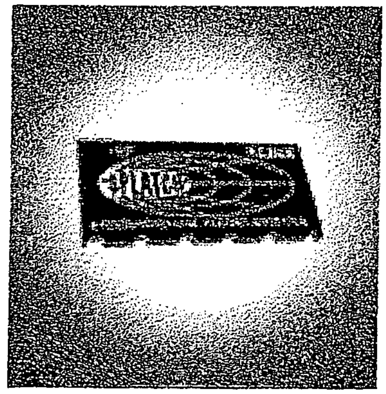
Wireless Products

Splatch Planar Antenna

WP-L-ANT-XXX-SP

SP Series

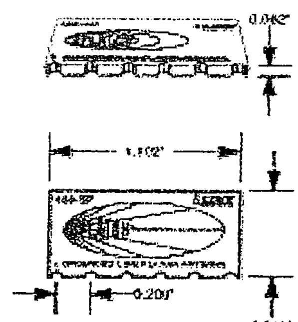
The Splatch uses a grounded line technique to achieve outstanding performance from a tiny surface-mount element. This unique antenna is designed for hand or reflow mounting directly to a product's circuit board. Its low cost makes it ideal for volume application. Unlike many compact antennas the Splatch exhibits good proximity performance making it an appropriate choice for hand-held applications such as remote controls, pagers, and alert devices. Typical performance is below that of many external antennas but the Splatch is an excellent choice when cosmetic or mechanical issues dictate the use of an internal antenna.



Features

- Ideal for concealed/internal mounting
- Direct PCB attachment
- Ultra-compact package
- Very low cost
- Suitable for hand or reflow assembly
- Resistant to proximity effect
- Perfect for compact portable devices

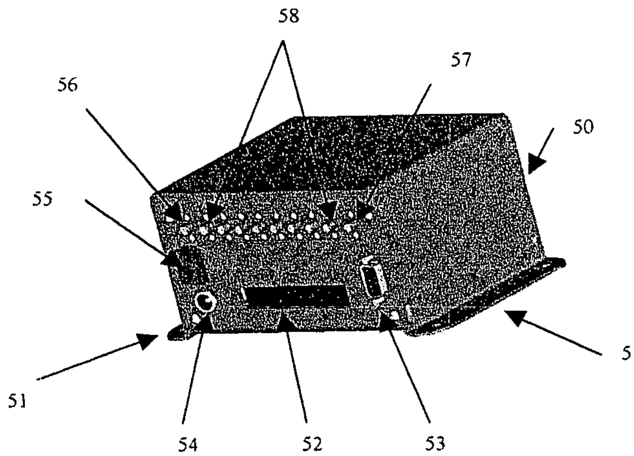
Technical Drawing



Ordering Information

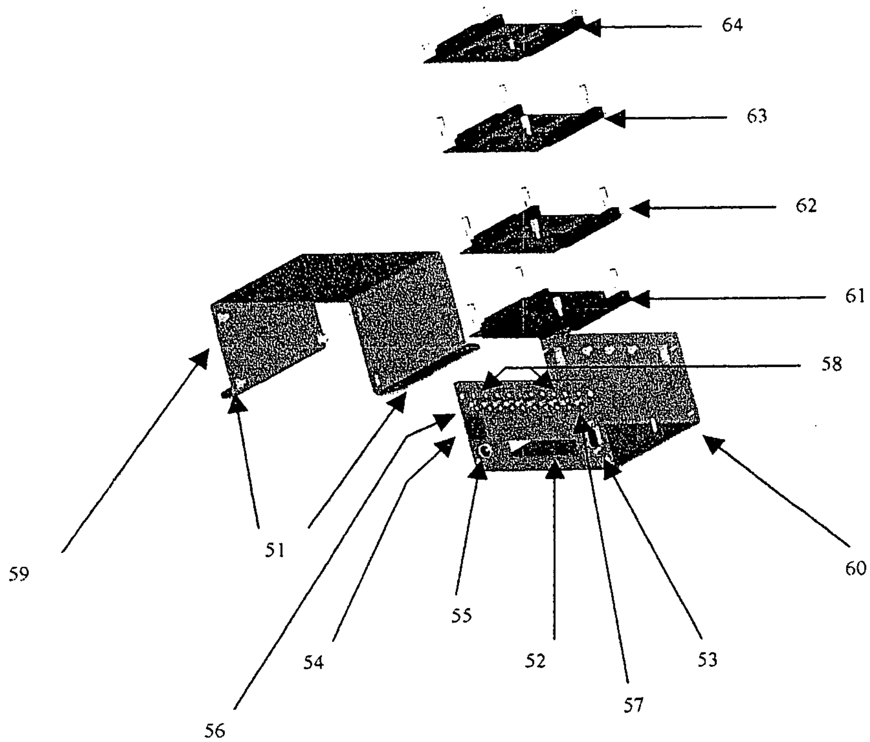
Part No.	Description
WP-L-ANT-315-SP	315 MHz Splatch Planar Antenna
WP-L-ANT-418-SP	418 MHz Splatch Planar Antenna
WP-L-ANT-433-SP	433 MHz Splatch Planar Antenna
WP-L-ANT-868-SP	868 MHz Splatch Planar Antenna
WP-L-ANT-916-SP	916 MHz Splatch Planar Antenna

FIG 2-74



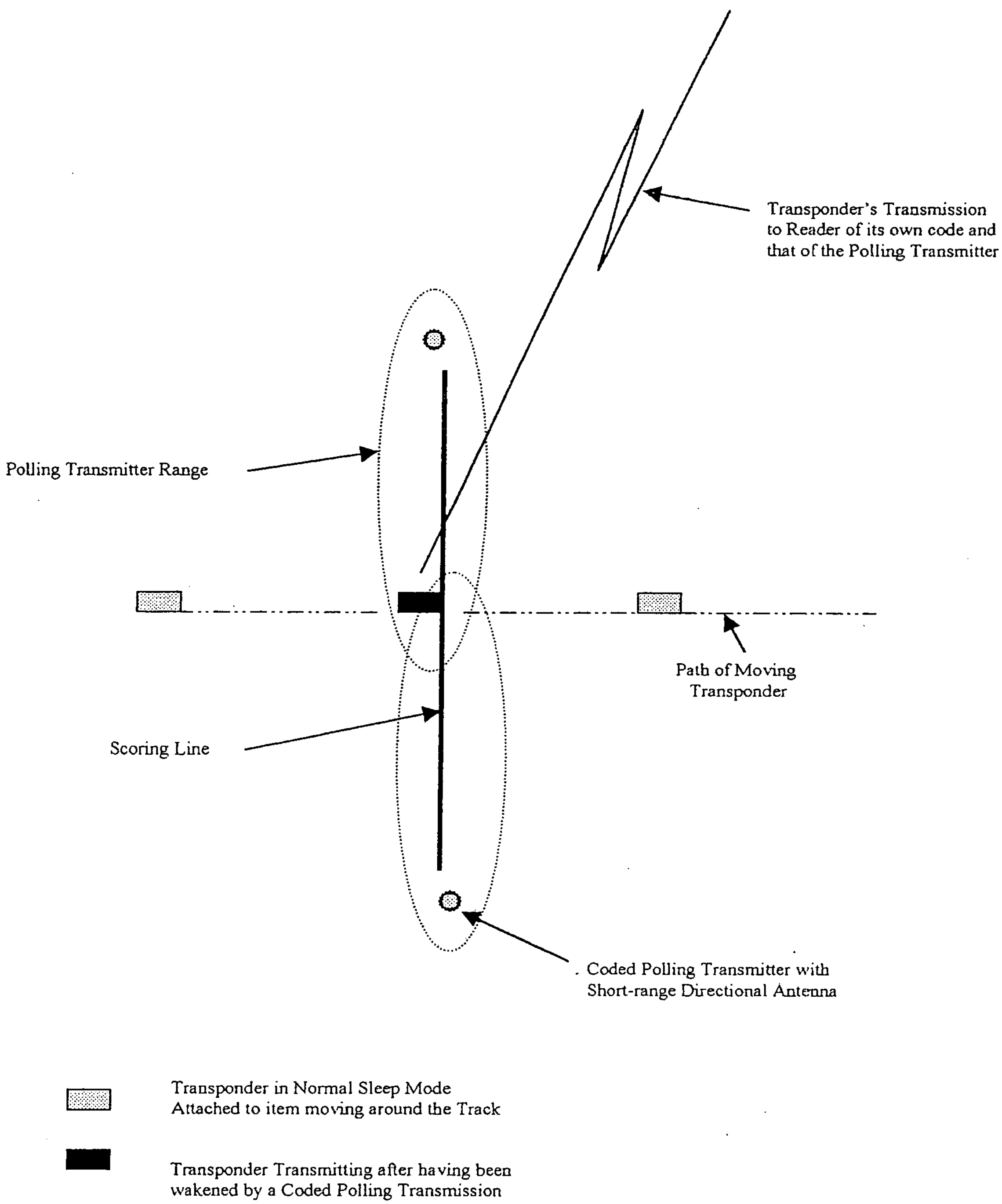
LITMIS RECEIVER PC-104 Version

FIG. 2-75



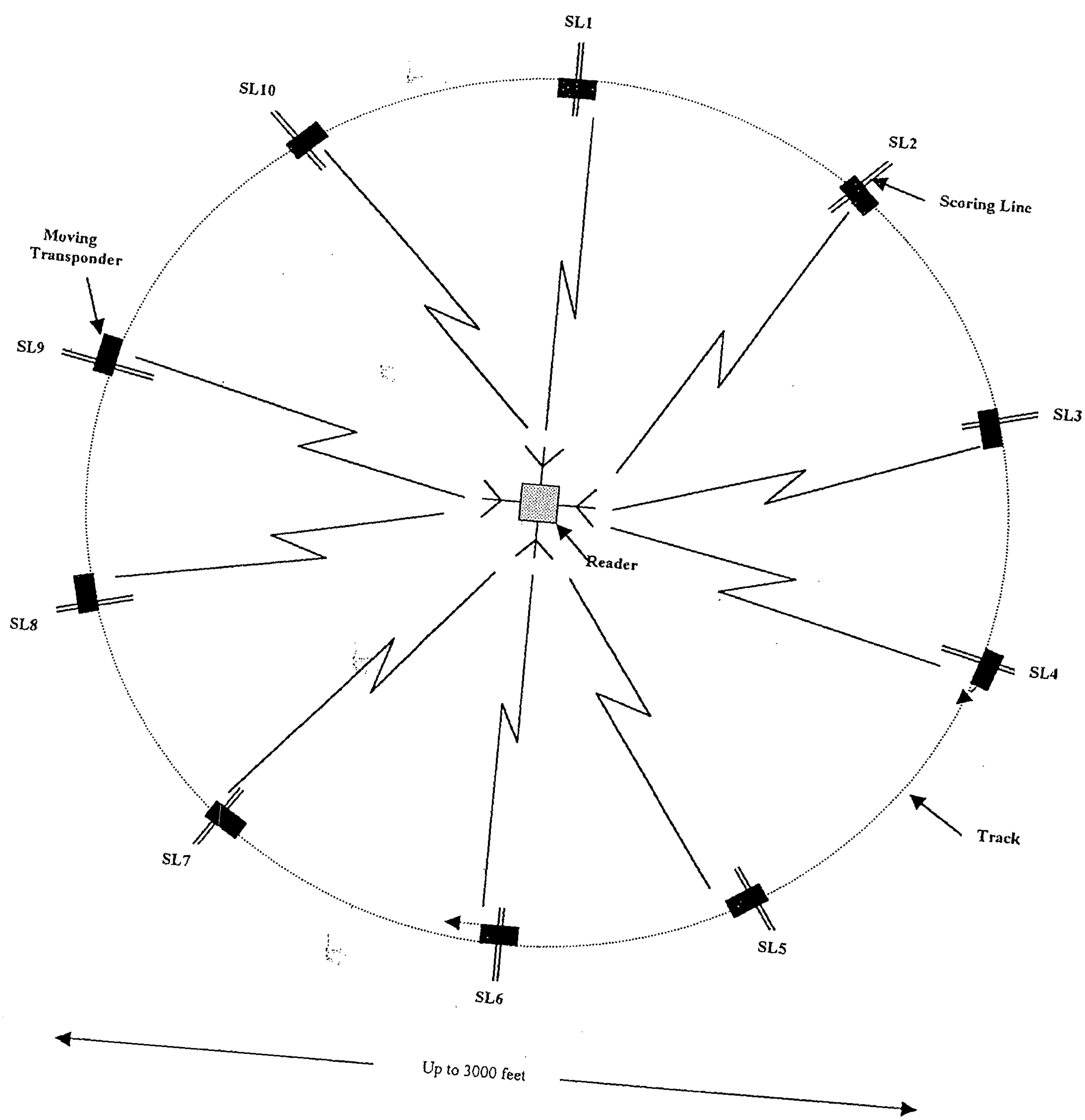
**EXPLODED VIEW OF
LITMIS RECEIVER PC-104 Version**

FIG. 2-76



Scoring Line Detail as Transponder Passes

FIG 2-77

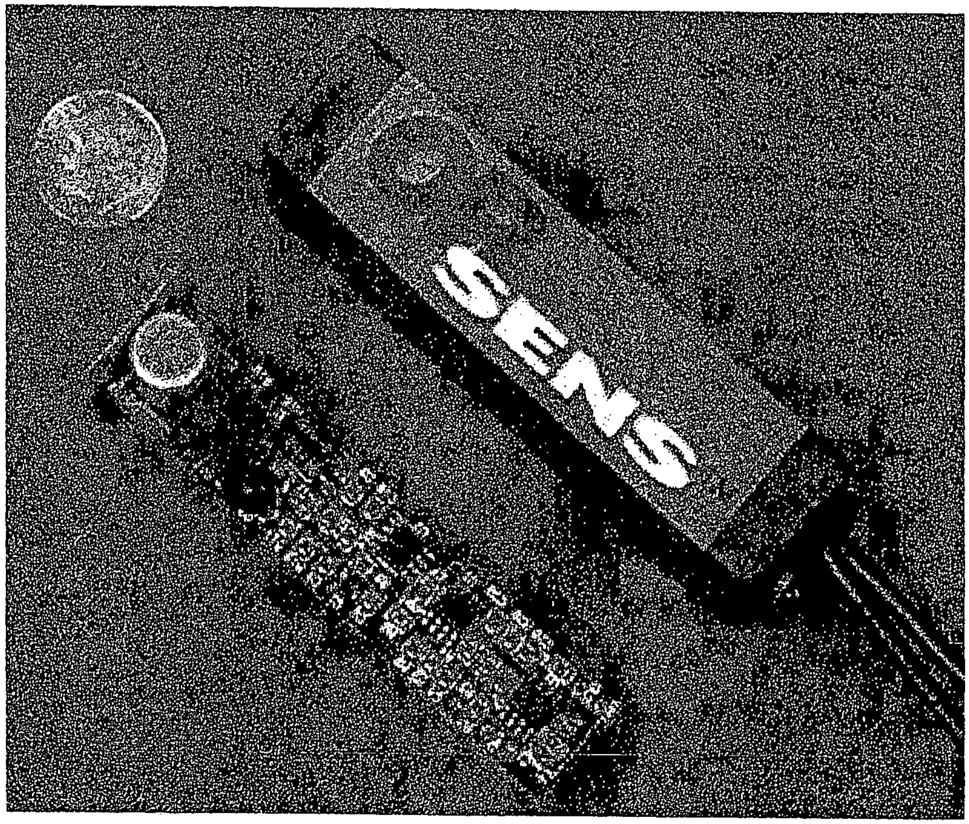


Multi Sport Scoring System

FIG 2-78

FIG. 2-79a

RADTELL™ Gamma-Ray Detector



Overview

The RADTELL™ gamma-ray sensor is a small, inexpensive, virtually passive hardware system designed for individual-item monitoring of radioactive materials. The system provides a method for maintaining 24-hour surveillance of stored radioactive items and recording any gamma-ray change. The system can be retrofitted into existing storage configurations and operated in

either a fixed or mobile mode. Applications include nonproliferation monitoring, spent fuel safeguards, and long-term monitoring of stored radioactive wastes.

Features

- Gamma-ray attribute measurement of each item in storage
- Discriminator lower level adjustment to correspond to an energy peak of uranium-235 (98 keV) or plutonium-239 (130 keV)
- Automatic indication of system problems
- Pulse height discrimination of unwanted noise
- Analog signal output
- Single +9 V supply requirement for power and detector bias (with optional high-voltage bias output)
- Stable low-cost preamplifier-amplifier electronics

System Operation

RADTELL™ sensors monitor the gamma-ray emission from special nuclear materials (SNMs). The sensors are affected by source (SNM) distance, collimation of the source, and the SNM container thickness and material. The count-rate is maximized by placing the sensors as close as possible to the source.

Main elements within the sensor unit are a CdZnTe gamma-ray detector, a low-noise preamplifier, and a pulse-shaping amplifier. Signal levels can be selected by a pulse height discriminator, lower-level adjustment for precise gamma-ray energy band monitoring of uranium-235. The Surface Mount Technology (SMT) circuit board is designed for use with either a silicon-PIN photodiode or a CdZnTe gamma-ray radiation detector.

Pulses resulting from the photon interactions in the RADTELL™ detector are produced at an approximate rate of 75,000 counts per second per R per hour. Filters in the pulse-shaping amplifier provide an impulse response having a pulse-width of 20 to 50 microseconds. After leaving the pulse-shaping amplifier, the output signals go to a pulse height discriminator where the discriminator lower level is adjusted to correspond to an energy peak of uranium-235 (98 keV) or plutonium-239 (130 keV). The gamma-ray energy band from either the calibrated uranium or plutonium peak to the highest energy from the Compton interaction pulses provides a sensitivity band with a precise region for monitoring either uranium enrichment or plutonium.

The SMT circuit board is 1.5 cm wide by 7.2 cm long.

FIG 2-79b

Hardware/Software Requirements

- ORSENS Sensor Concentrator
- ORSENS Common Sensor Interface Unit
- An Intel Pentium II based computer (or higher)
- At least 32 MB of RAM
- A minimum of 15 MB of free hard disk space

For more information, contact
Mr. Chris A. Pickett
Y-12 National Security Complex
Voice: (865) 574-0891 Fax: (865) 576-2782
email: pickettca@y12.doe.gov

Systems Sensors Publications Home Contact Links Disclaimer

FIG 2-79c

FIG. 2-80

ID&M SYSTEMS CORPORATION PHASE V

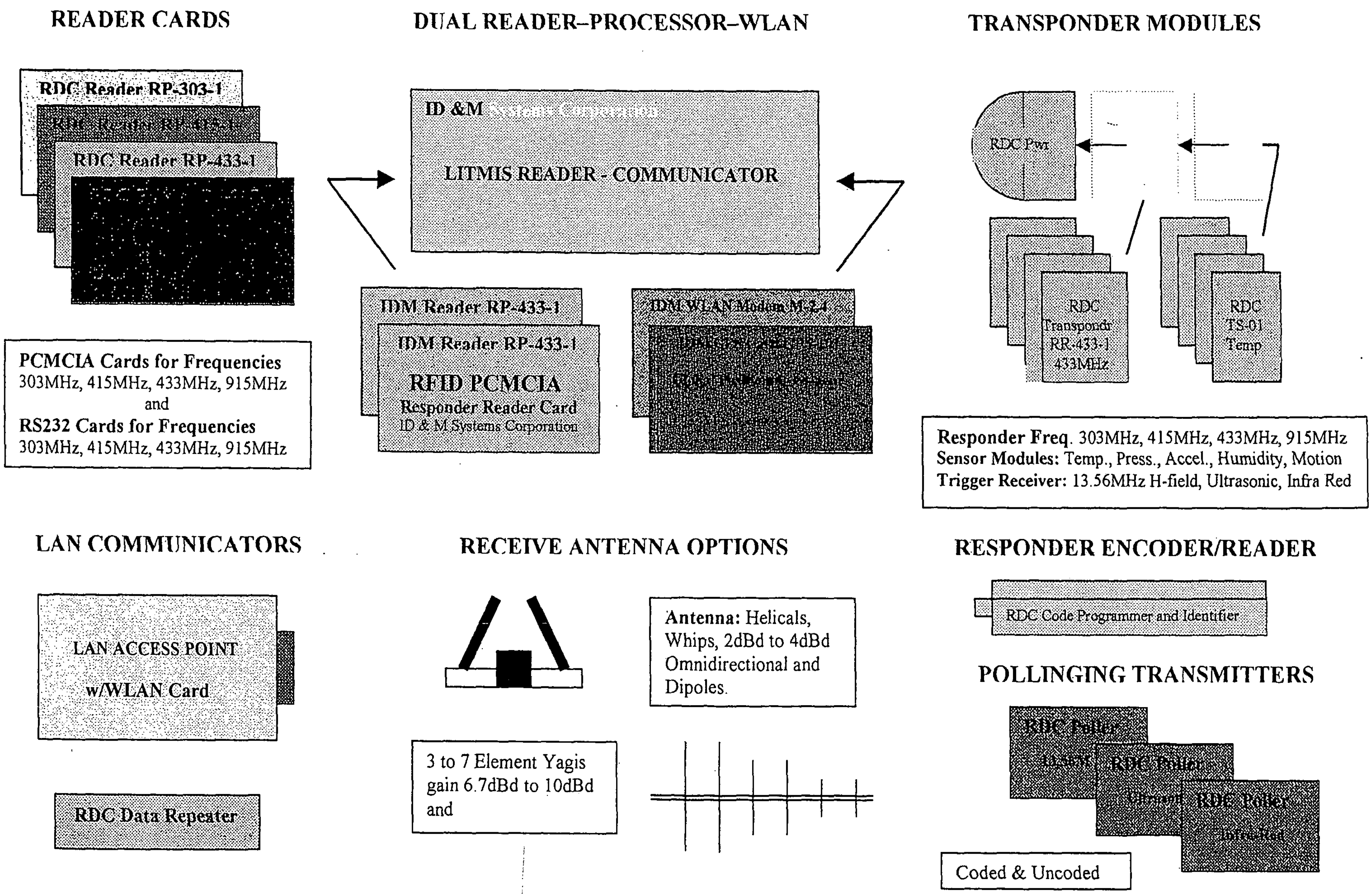


FIG. 2-81

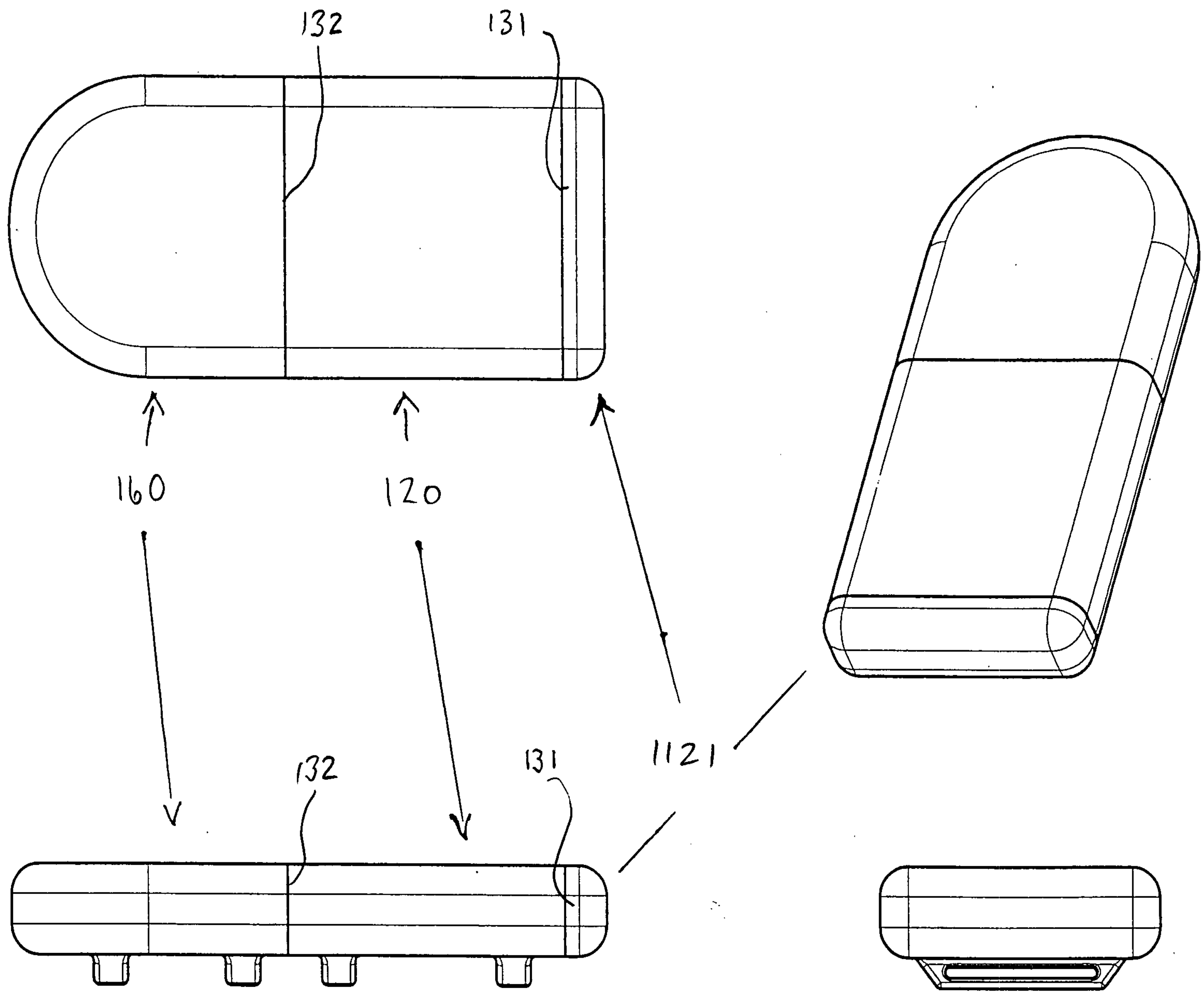


FIG. 3

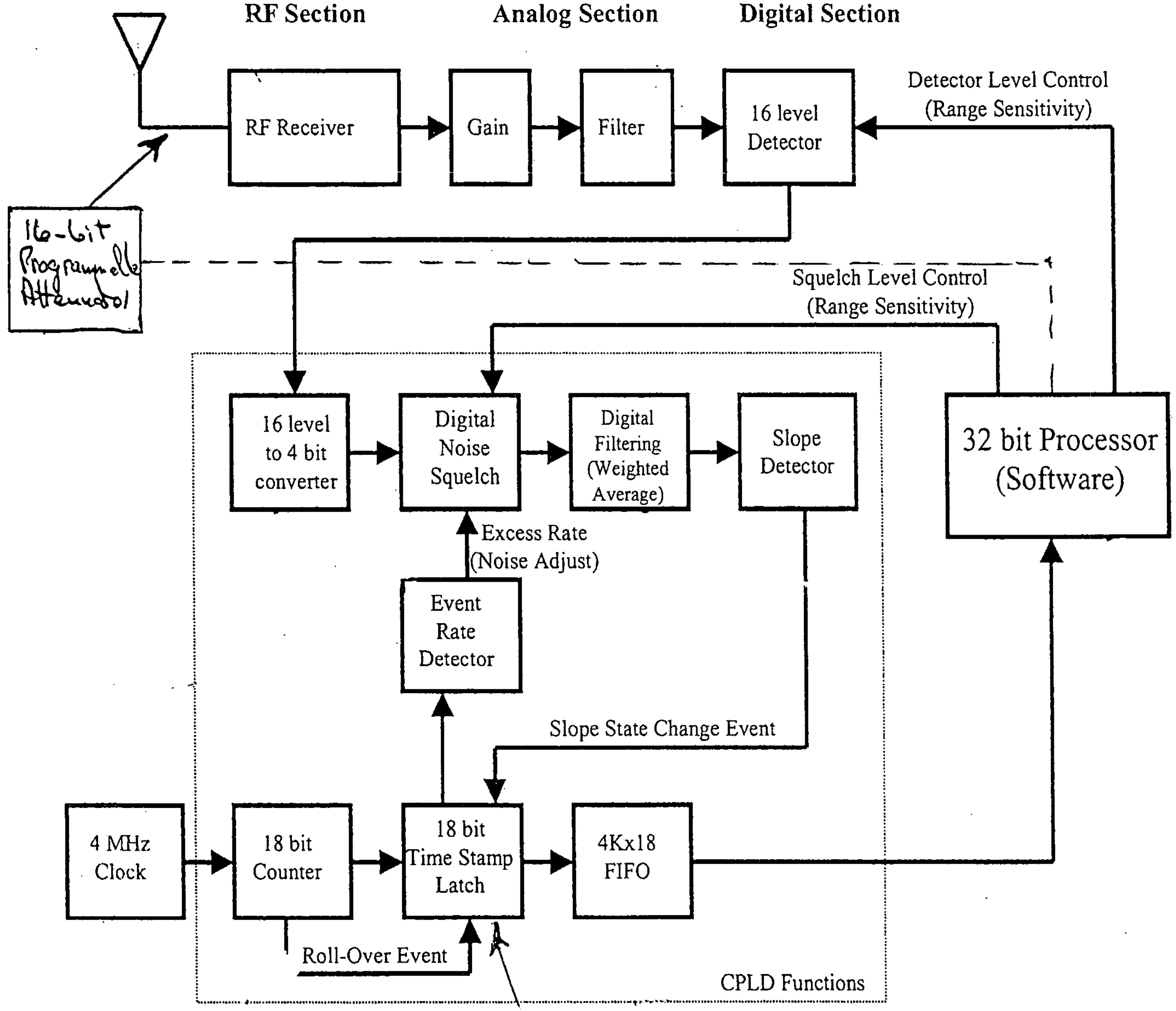

RF Section
Analog Section
Digital Section
RF Receiver
Gain
Filter
16 level Detector
Detector Level Control (Range Sensitivity)
16-bit Programmable Attenuator
Squelch Level Control (Range Sensitivity)
16 level to 4 bit converter
Digital Noise Squelch
Digital Filtering (Weighted Average)
Slope Detector
32 bit Processor (Software)
Excess Rate (Noise Adjust)
Event Rate Detector
Slope State Change Event
4 MHz Clock
18 bit Counter
18 bit Time Stamp Latch
4Kx18 FIFO
Roll-Over Event
CPLD Functions

FIG. 4

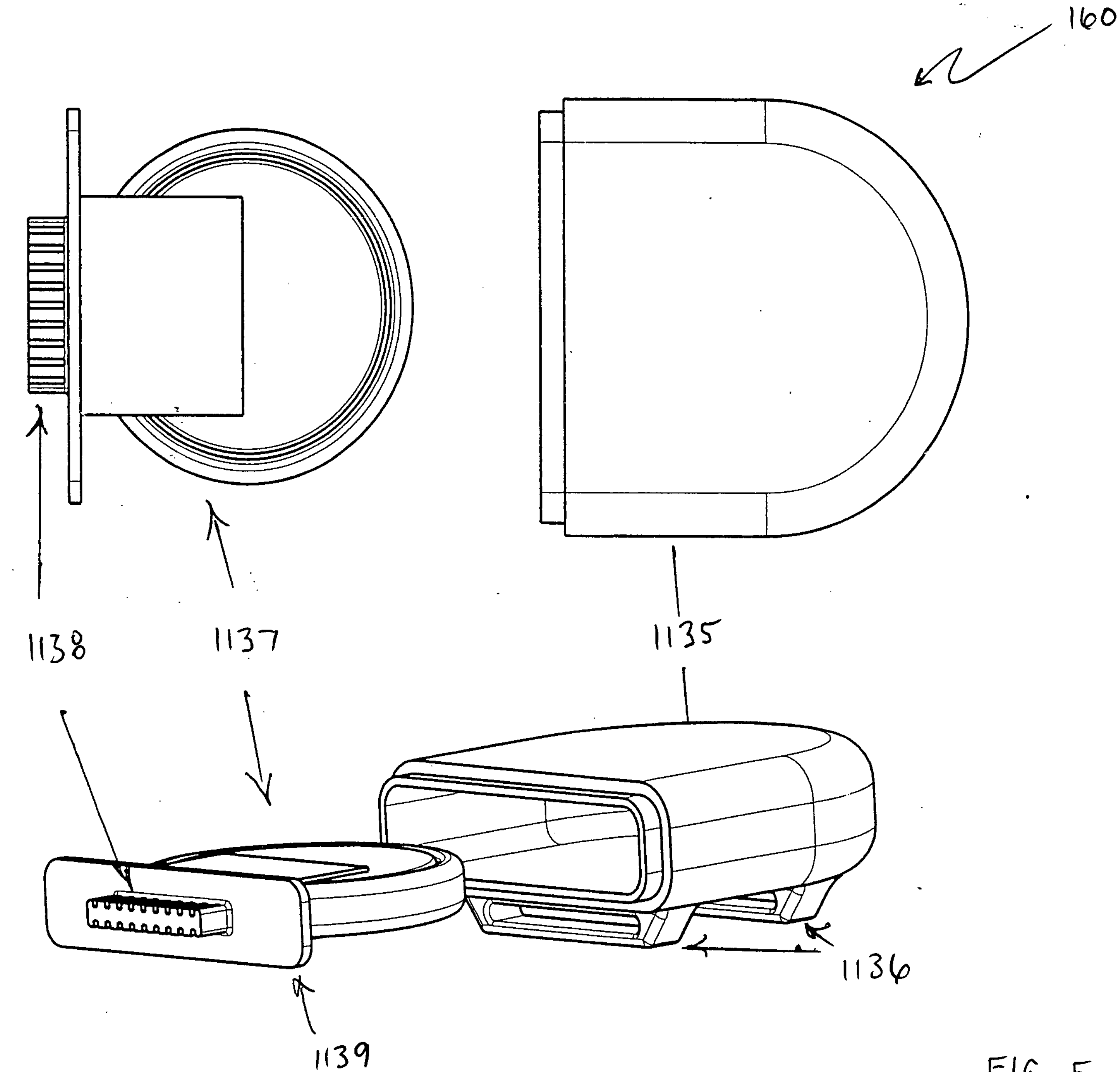


FIG. 5

TRANSCEIVER CIRCUIT FOR TRANSPONDERS AND RECEIVERS COMMUNICATING ON THE SAME FREQUENCY

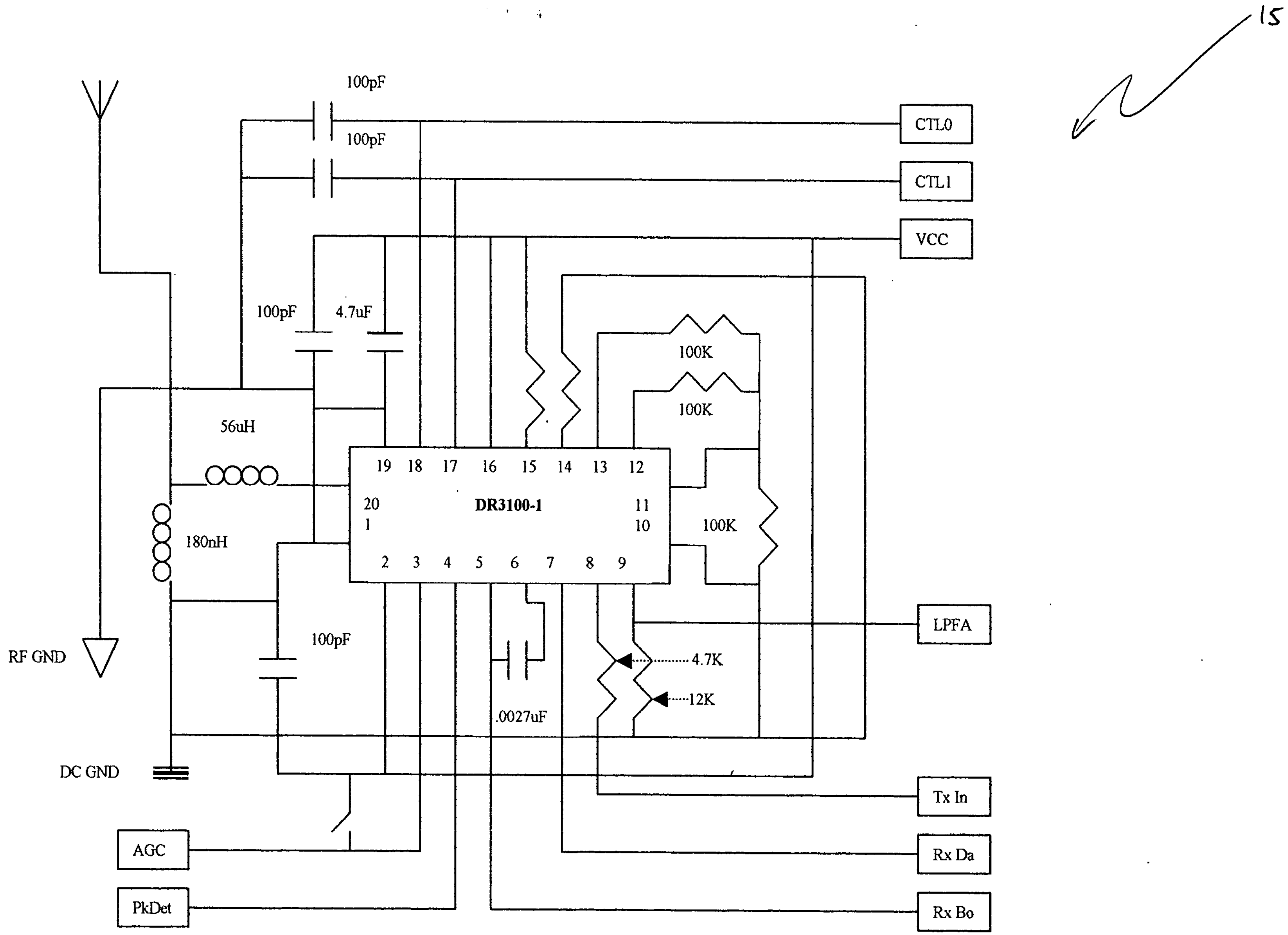


FIG 6-00

151

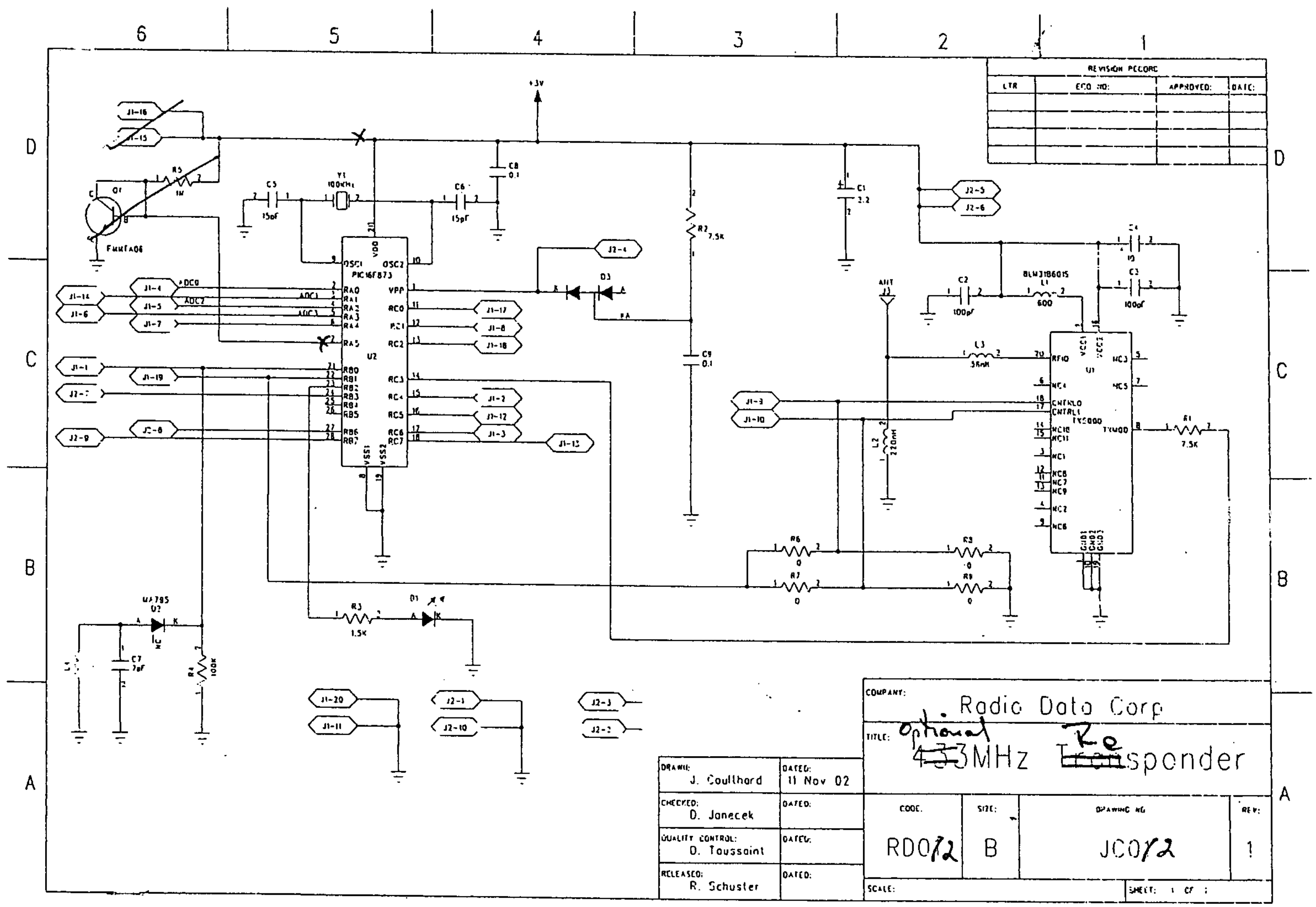

Radio Data Corp
optional 433MHz Re Transponder
J. Coulthard
11 Nov 02
D. Janecek
D. Toussaint
R. Schuster
RD0?2
B
JC0?2
1
PIC16F873
TX5000
REVISION RECORD

FIG. 6-01

TRANSPONDER FREQUENCY, MODULATION, POLLING AND FIRMWARE OPTIONS

Part Number	Frequency	Modulation	Polling	Firmware	Part Number	Frequency	Modulation	Polling	Firmware
-000139-01-01	433.92MHz	Optional	None	Basic Demo	03-000139-06-01	433.92MHz	Optional	13.56MHz Unc	Basic Demo
000139-01-02	433.92MHz	Optional	None	SSI WAMS	03-000139-06-02	433.92MHz	Optional	13.56MHz Unc	SSI WAMS
03-000139-01-03	433.92MHz	Optional	None	S&G Code	03-000139-06-03	433.92MHz	Optional	13.56MHz Unc	S&G Code
03-000139-01-04	433.92MHz	Optional	None	Medical I	03-000139-06-04	433.92MHz	Optional	13.56MHz Unc	Medical I
03-000139-01-05	433.92MHz	Optional	None	Home Sec. I	03-000139-06-05	433.92MHz	Optional	13.56MHz Unc	Home Sec. I
03-000139-02-01	433.92MHz	OOK	None	Basic Demo	03-000139-07-01	433.92MHz	OOK	13.56MHz Unc	Basic Demo
03-000139-02-02	433.92MHz	OOK	None	SSI WAMS	03-000139-07-02	433.92MHz	OOK	13.56MHz Unc	SSI WAMS
03-000139-02-03	433.92MHz	OOK	None	S&G Code	03-000139-07-03	433.92MHz	OOK	13.56MHz Unc	S&G Code
03-000139-02-04	433.92MHz	OOK	None	Medical I	03-000139-07-04	433.92MHz	OOK	13.56MHz Unc	Medical I
03-000139-02-05	433.92MHz	OOK	None	Home Sec. I	03-000139-07-05	433.92MHz	OOK	13.56MHz Unc	Home Sec. I
03-000139-03-01	433.92MHz	ASK	None	Basic Demo	03-000139-08-01	433.92MHz	ASK	13.56MHz Unc	Basic Demo
03-000139-03-02	433.92MHz	ASK	None	SSI WAMS	03-000139-08-02	433.92MHz	ASK	13.56MHz Unc	SSI WAMS
03-000139-03-03	433.92MHz	ASK	None	S&G Code	03-000139-08-03	433.92MHz	ASK	13.56MHz Unc	S&G Code
03-000139-03-04	433.92MHz	ASK	None	Medical I	03-000139-08-04	433.92MHz	ASK	13.56MHz Unc	Medical I
03-000139-03-05	433.92MHz	ASK	None	Home Sec. I	03-000139-08-05	433.92MHz	ASK	13.56MHz Unc	Home Sec. I
03-000139-11-01	303.825MHz	Optional	None	Basic Demo	03-000139-16-01	303.825MHz	Optional	13.56MHz Unc	Basic Demo
03-000139-11-02	303.825MHz	Optional	None	SSI WAMS	03-000139-16-02	303.825MHz	Optional	13.56MHz Unc	SSI WAMS
03-000139-11-03	303.825MHz	Optional	None	S&G Code	03-000139-16-03	303.825MHz	Optional	13.56MHz Unc	S&G Code
03-000139-11-04	303.825MHz	Optional	None	Medical I	03-000139-16-04	303.825MHz	Optional	13.56MHz Unc	Medical I
03-000139-11-05	303.825MHz	Optional	None	Home Sec. I	03-000139-16-05	303.825MHz	Optional	13.56MHz Unc	Home Sec. I
03-000139-12-01	303.825MHz	OOK	None	Basic Demo	03-000139-17-01	303.825MHz	OOK	13.56MHz Unc	Basic Demo
03-000139-12-02	303.825MHz	OOK	None	SSI WAMS	03-000139-17-02	303.825MHz	OOK	13.56MHz Unc	SSI WAMS
03-000139-12-13	303.825MHz	OOK	None	S&G Code	03-000139-17-13	303.825MHz	OOK	13.56MHz Unc	S&G Code
03-000139-12-04	303.825MHz	OOK	None	Medical I	03-000139-17-04	303.825MHz	OOK	13.56MHz Unc	Medical I
03-000139-12-05	303.825MHz	OOK	None	Home Sec. I	03-000139-17-05	303.825MHz	OOK	13.56MHz Unc	Home Sec. I
03-000139-13-01	303.825MHz	ASK	None	Basic Demo	03-000139-18-01	303.825MHz	ASK	13.56MHz Unc	Basic Demo
03-000139-13-02	303.825MHz	ASK	None	SSI WAMS	03-000139-18-02	303.825MHz	ASK	13.56MHz Unc	SSI WAMS
-000139-13-03	303.825MHz	ASK	None	S&G Code	03-000139-18-03	303.825MHz	ASK	13.56MHz Unc	S&G Code
000139-13-04	303.825MHz	ASK	None	Medical I	03-000139-18-04	303.825MHz	ASK	13.56MHz Unc	Medical I
03-000139-13-05	303.825MHz	ASK	None	Home Sec. I	03-000139-18-05	303.825MHz	ASK	13.56MHz Unc	Home Sec. I
03-000139-21-01	418MHz	Optional	None	Basic Demo	03-000139-26-01	418MHz	Optional	13.56MHz Unc	Basic Demo
03-000139-21-02	418MHz	Optional	None	SSI WAMS	03-000139-26-02	418MHz	Optional	13.56MHz Unc	SSI WAMS
03-000139-21-03	418MHz	Optional	None	S&G Code	03-000139-26-03	418MHz	Optional	13.56MHz Unc	S&G Code
03-000139-21-04	418MHz	Optional	None	Medical I	03-000139-26-04	418MHz	Optional	13.56MHz Unc	Medical I
03-000139-21-05	418MHz	Optional	None	Home Sec. I	03-000139-26-05	418MHz	Optional	13.56MHz Unc	Home Sec. I
03-000139-22-01	418MHz	OOK	None	Basic Demo	03-000139-27-01	418MHz	OOK	13.56MHz Unc	Basic Demo
03-000139-22-02	418MHz	OOK	None	SSI WAMS	03-000139-27-02	418MHz	OOK	13.56MHz Unc	SSI WAMS
03-000139-22-03	418MHz	OOK	None	S&G Code	03-000139-27-03	418MHz	OOK	13.56MHz Unc	S&G Code
03-000139-22-04	418MHz	OOK	None	Medical I	03-000139-27-04	418MHz	OOK	13.56MHz Unc	Medical I
03-000139-22-05	418MHz	OOK	None	Home Sec. I	03-000139-27-05	418MHz	OOK	13.56MHz Unc	Home Sec. I
03-000139-23-01	418MHz	ASK	None	Basic Demo	03-000139-28-01	418MHz	ASK	13.56MHz Unc	Basic Demo
03-000139-23-02	418MHz	ASK	None	SSI WAMS	03-000139-28-02	418MHz	ASK	13.56MHz Unc	SSI WAMS
03-000139-23-03	418MHz	ASK	None	S&G Code	03-000139-28-03	418MHz	ASK	13.56MHz Unc	S&G Code
03-000139-23-04	418MHz	ASK	None	Medical I	03-000139-28-04	418MHz	ASK	13.56MHz Unc	Medical I
03-000139-23-05	418MHz	ASK	None	Home Sec. I	03-000139-28-05	418MHz	ASK	13.56MHz Unc	Home Sec. I
03-000139-31-01	916.5MHz	Optional	None	Basic Demo	03-000139-36-01	916.5MHz	Optional	13.56MHz Unc	Basic Demo
03-000139-31-02	916.5MHz	Optional	None	SSI WAMS	03-000139-36-02	916.5MHz	Optional	13.56MHz Unc	SSI WAMS
03-000139-31-03	916.5MHz	Optional	None	S&G Code	03-000139-36-03	916.5MHz	Optional	13.56MHz Unc	S&G Code
03-000139-31-04	916.5MHz	Optional	None	Medical I	03-000139-36-04	916.5MHz	Optional	13.56MHz Unc	Medical I
03-000139-31-05	916.5MHz	Optional	None	Home Sec. I	03-000139-36-05	916.5MHz	Optional	13.56MHz Unc	Home Sec. I
03-000139-32-01	916.5MHz	OOK	None	Basic Demo	03-000139-37-06	916.5MHz	OOK	13.56MHz Unc	Basic Demo
03-000139-32-02	916.5MHz	OOK	None	SSI WAMS	03-000139-37-07	916.5MHz	OOK	13.56MHz Unc	SSI WAMS
03-000139-32-03	916.5MHz	OOK	None	S&G Code	03-000139-37-08	916.5MHz	OOK	13.56MHz Unc	S&G Code
03-000139-32-04	916.5MHz	OOK	None	Medical I	03-000139-37-09	916.5MHz	OOK	13.56MHz Unc	Medical I
03-000139-32-05	916.5MHz	OOK	None	Home Sec. I	03-000139-37-10	916.5MHz	OOK	13.56MHz Unc	Home Sec. I
000139-33-01	916.5MHz	ASK	None	Basic Demo	03-000139-38-01	916.5MHz	ASK	13.56MHz Unc	Basic Demo
03-000139-33-02	916.5MHz	ASK	None	SSI WAMS	03-000139-38-02	916.5MHz	ASK	13.56MHz Unc	SSI WAMS
03-000139-33-03	916.5MHz	ASK	None	S&G Code	03-000139-38-03	916.5MHz	ASK	13.56MHz Unc	S&G Code
03-000139-33-04	916.5MHz	ASK	None	Medical I	03-000139-38-04	916.5MHz	ASK	13.56MHz Unc	Medical I
03-000139-33-05	916.5MHz	ASK	None	Home Sec. I	03-000139-38-05	916.5MHz	ASK	13.56MHz Unc	Home Sec. I

FIG. 7

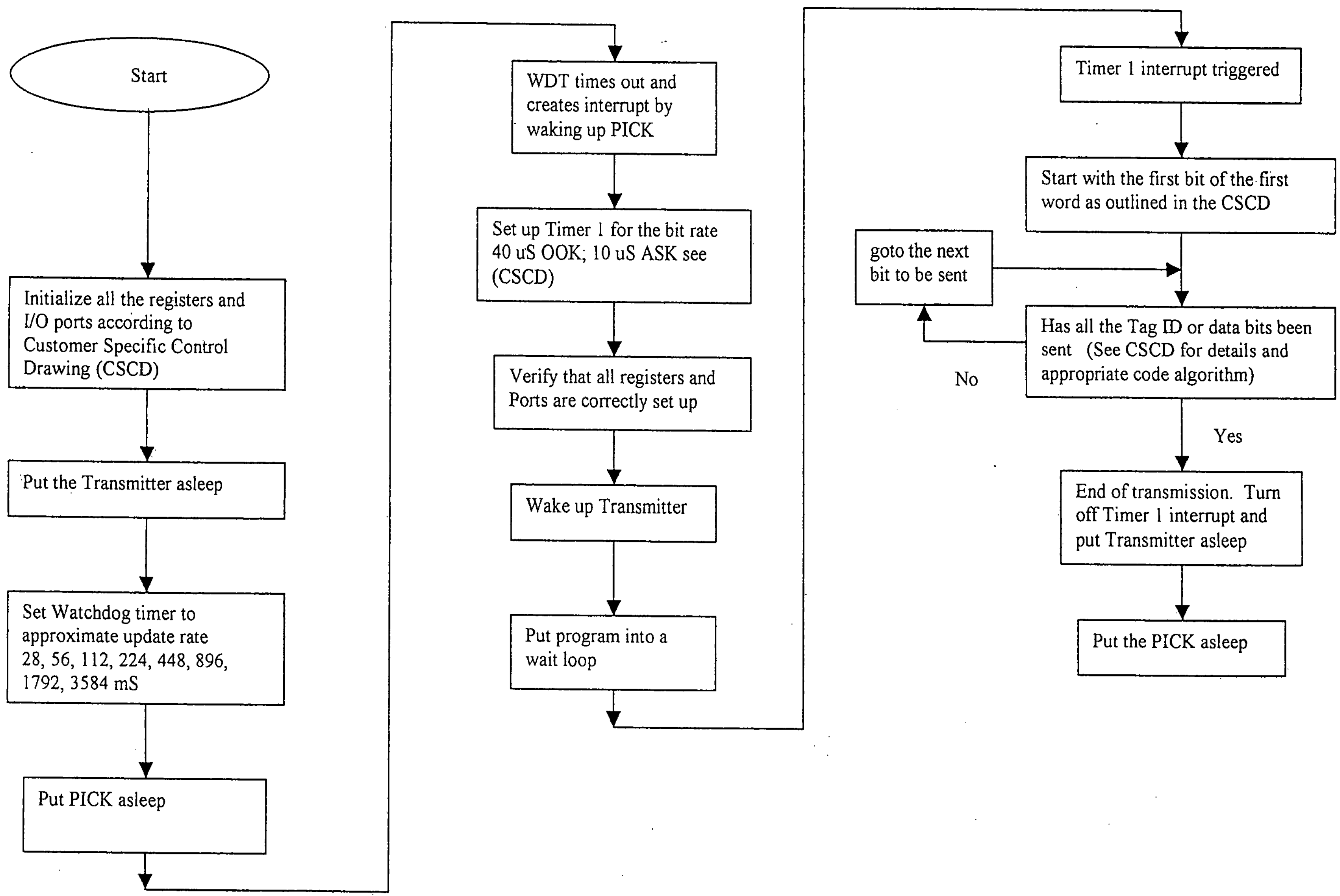

Start
Initialize all the registers and I/O ports according to Customer Specific Control Drawing (CSCD)
Put the Transmitter asleep
Set Watchdog timer to approximate update rate 28, 56, 112, 224, 448, 896, 1792, 3584 mS
Put PICK asleep
WDT times out and creates interrupt by waking up PICK
Set up Timer 1 for the bit rate 40 uS OOK; 10 uS ASK see (CSCD)
Verify that all registers and Ports are correctly set up
Wake up Transmitter
Put program into a wait loop
Timer 1 interrupt triggered
Start with the first bit of the first word as outlined in the CSCD
goto the next bit to be sent
Has all the Tag ID or data bits been sent (See CSCD for details and appropriate code algorithm)
No
Yes
End of transmission. Turn off Timer 1 interrupt and put Transmitter asleep
Put the PICK asleep

FIG. 8

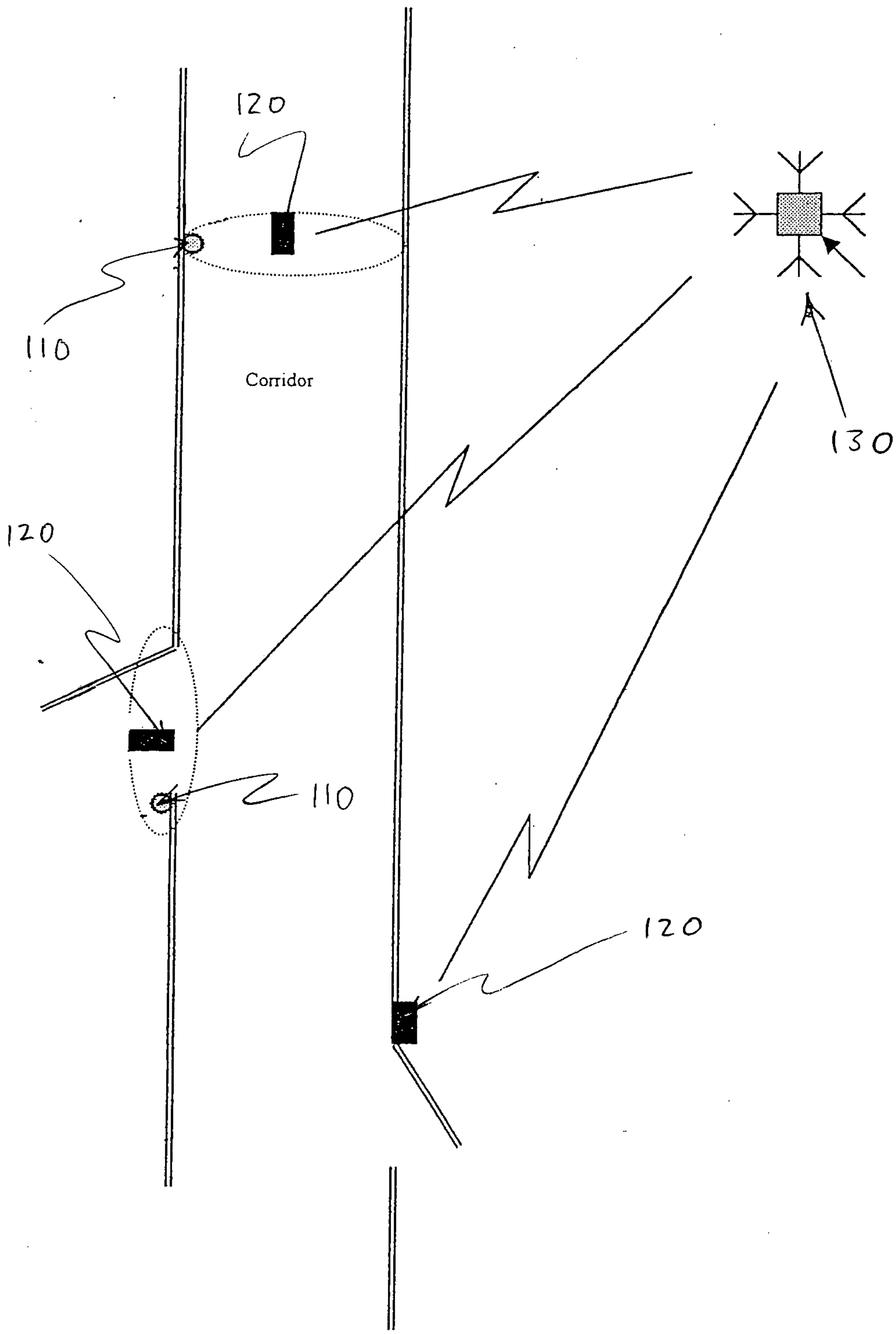


FIG. 9

TRANSPONDER TRANSMISSION PERIODICITY DECISION TABLE

Example of a Sensor Sampling Plan (Truck Wheel Monitoring)

Step 1	Wake up every 2 seconds, take 3 samples, average closest two readings, store in A
Step 2	Wake up every 2 seconds, move store A to store B, take 3 samples, average closest two readings, store in A
Step 3	Wake up every 2 seconds, move store B to store C, move store A to store B, take 3 samples, average closest two readings, store in A
Step 4	Compare value of data stored in A with limit table and react accordingly
Step 5	Average the averages stored in A, B and C and store in D
Step 6	Compare value of data stored in A with data stored in B, check change with Rate of Change Table and react accordingly
Step 7 plus	Continue to repeat steps 3 through 6 indefinately

Example of a Limit Table (Truck Wheel Monitoring)

Normal	Convert	Transmit	Repeat	
plus/minus	every	every	ea Tx	
0 to 12.5%	300 secs	300 secs	3 times	
12.5 to 25%	90 secs	90 secs	6 times	Warn
25 to 50%	30 secs	30 secs	25 times	Alert
over 50%	10 secs	10 secs	50 times	Alarm

Example of Rate of Change Table (Truck Wheel Monitoring)

Change	Convert	Transmit	Repeat	Action
greater than	every	every	ea Tx	
0%	450 secs	900 secs	3 times	
6.25%	150 secs	300 secs	6 times	Warn
12.50%	90 secs	90 secs	12 times	Alert 1
25%	30 secs	30 secs	25 times	Alert 2
50%	10 secs	10 secs	50 times	Alarm

Note: Each sensed parameter is analysed and the response is determined for each parameter. However the data transmission periodicity and repetition is determined by the most critical parameter (the transmission format is always the same).

FIG. 10

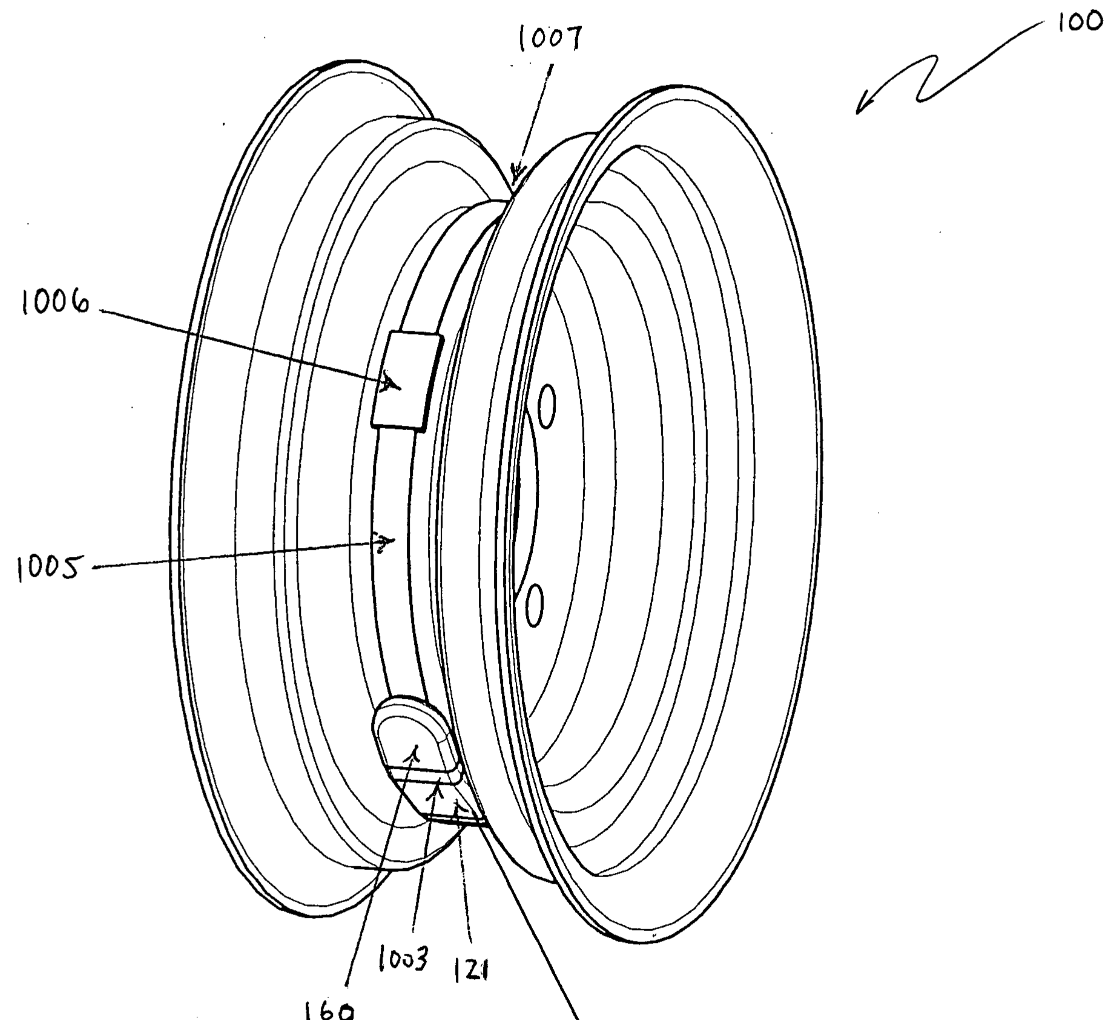


FIG. 11

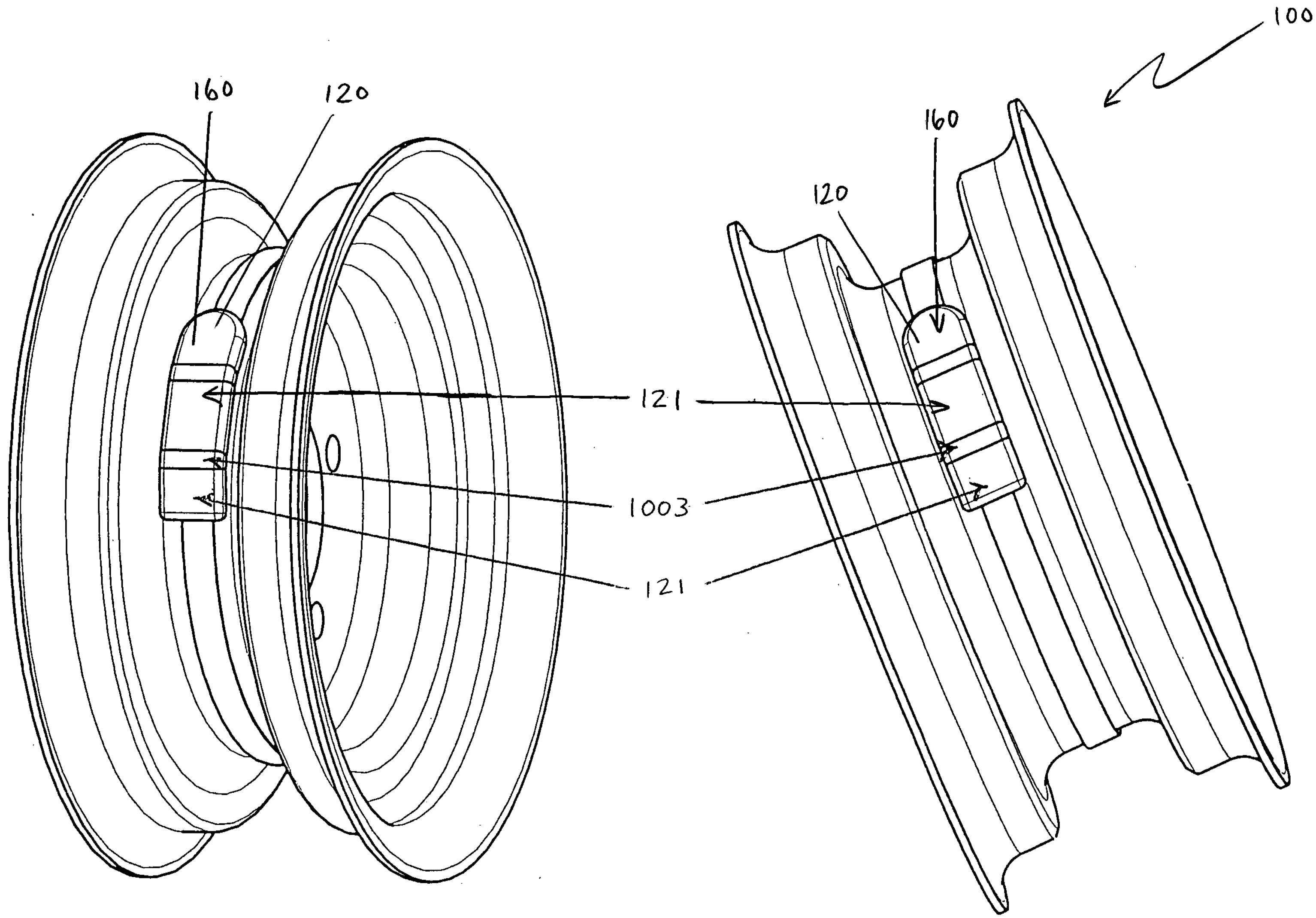


FIG. 12

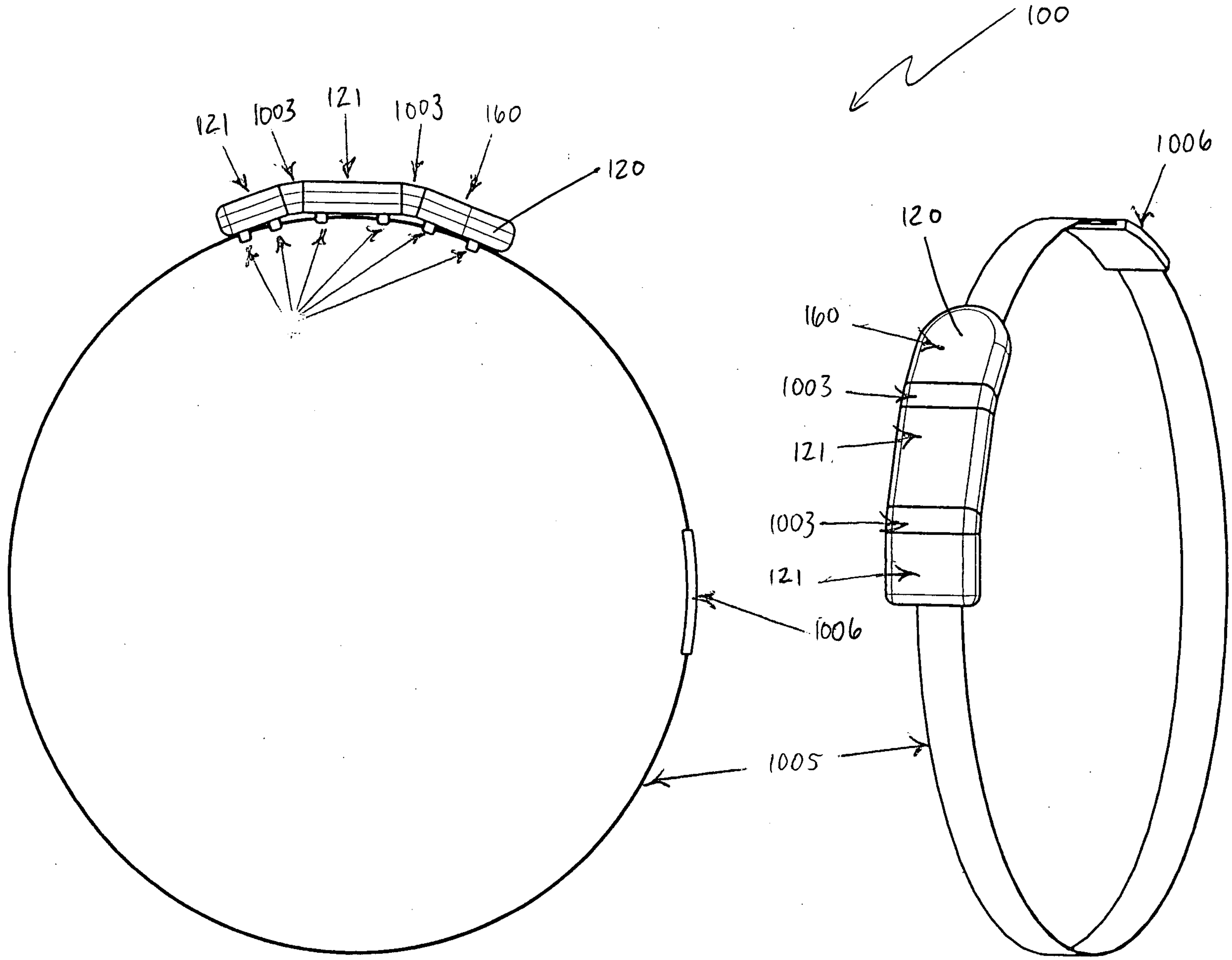

100
121
1003
121
1003
160
120
1006
120
160
1003
121
1003
121
1006
1005

FIG. 13

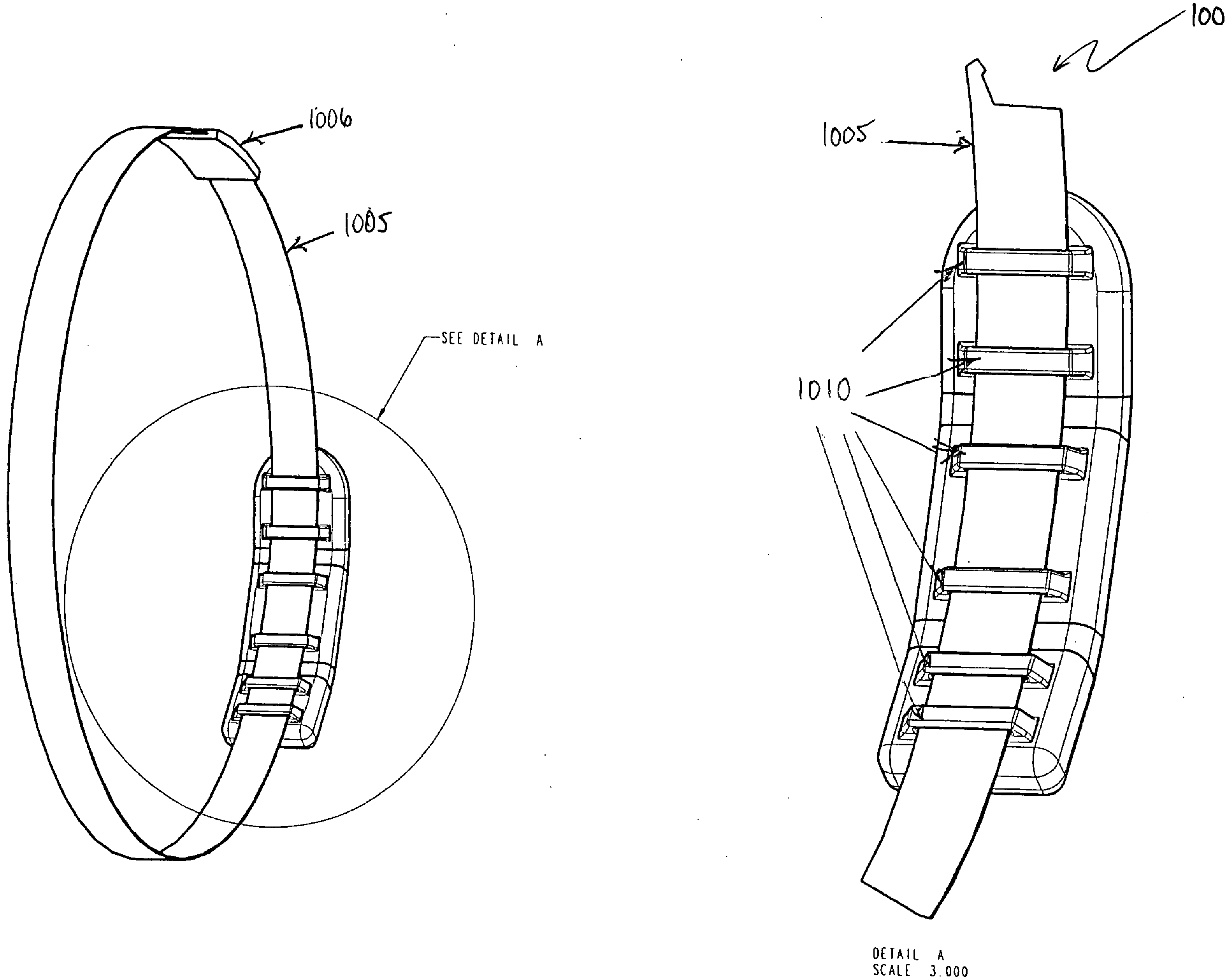


FIG. 14